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THE GEOGRAPHICAL DISTRIBUTION OF COLD-BLOODED VERTEBRATES

(CONCLUDED)

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DISPERSAL AND CLIMATE

DESCRIPTION of the actual distributions of existing cold-blooded vertebrate groups has been completed in the preceding section. This and the following sections will be concerned with analysis and discussion.

Matthew, in *Climate and Evolution* (1915, pp. 172–173; 1939, p. 3), states a thesis which can be reduced to two main propositions: (1) that the north temperate zone, because of its variable climate, has been the principal center of evolution and dispersal of land vertebrates, and (2) that no great changes in world geography, and no extraordinary land bridges, are necessary to account for vertebrate distribution.

I think that the first of these propositions is wrong, so far as cold-blooded vertebrates are concerned. Fresh-water fishes, amphibians, and reptiles seem all to have dispersed from the tropics into the north temperate zone, more than the reverse. Some of them that have been in the north have withdrawn from there, but that does not mean that they originated there. Failure to distinguish evidence of withdrawal from evidence of origin and spreading is a basic error. The north temperate zone, especially its colder part, is apparently not a great center of evolution of cold-blooded vertebrate life, but a marginal area where such life is limited.

North temperate climate is characterized primarily by a lower mean temperature than that of the tropics and by an alternation of warm and cold seasons. The effect of these factors on cold-blooded vertebrates is probably complex. Different groups reach their northern limits at no definite isotherms and in no fixed order (Figure 3). Obviously, the limiting effect of climate will have to be looked for, not in the simple effect of single factors on single species, but in general correlations.

There is a definite correlation between northern limits, the development of independent north temperate faunas, and the distribution of phylogenetic relicts in the different classes of cold-blooded vertebrates. Fresh-water fishes go farthest north, and are numerous in cold north temperate climates; they have developed an independent north temperate fauna characterized by peculiar familes and even orders; and relicts of ancient groups occur in the north temperate zone as well as in the tropics and Australia. Amphibians reach the Arctic more or less around the world, and are fairly numerous in the colder parts of the north temperate zone; they have developed an independent north temperate fauna characterized by salamanders and a few more or less dis-

tinct groups of frogs; and archaic relicts are scattered in the north temperate zone as well as in the the tropics and New Zealand. Reptiles fall far short of the Arctic in most parts of the world, and are relatively few in the colder parts of the north temperate zone [e. g., Schreiber (1912) lists only 5 genera, 6 species of reptiles to 6 genera, 11 species of amphibians in northern Europe, but 37 genera, 89 species of reptiles to 14 genera, 39 species of amphibians in southern Europe]; reptiles have developed no well defined north temperate fauna; and they lack isolated archaic relicts pe-

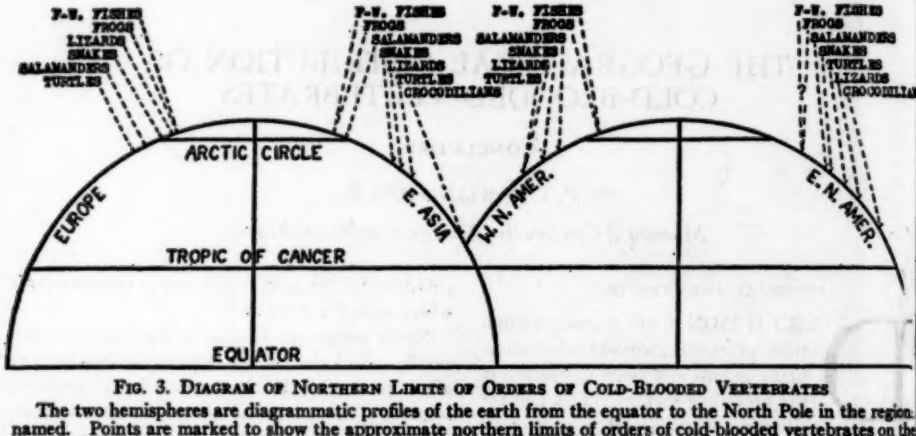

FIG. 3. DIAGRAM OF NORTHERN LIMITS OF ORDERS OF COLD-BLOODED VERTEBRATES

The two hemispheres are diagrammatic profiles of the earth from the equator to the North Pole in the region named. Points are marked to show the approximate northern limits of orders of cold-blooded vertebrates on the curve of the earth in each region. Data on which the diagram is based are given in the text. The diagram is provisional. It is fairly accurate for Europe, next best for western North America, least accurate for eastern Asia and eastern North America.

culiar to the north temperate zone. Apparently, then, fresh-water fishes are most successful in the north, and evolve and persist there for long periods. Amphibians are fairly successful there, and evolve and persist in some cases. But reptiles are not successful there, and although they invade cold northern regions, they do not evolve there much nor persist there long.

The success of cold-blooded vertebrates in the north varies with their place on the evolutionary scale: fishes, the lowest forms, are most successful; reptiles, the highest, least so. This has something to do with reproduction and something to do with habitat. Fishes have the most primitive, simplest mode of reproduction and the one which, I suppose, is least affected by cold. Amphibians have a more complicated development, but some of them can shorten the larval period sufficiently to complete it during the short arctic summer (cf. Moore, 1942, p. 194); their heat requirements are apparently not great. Reptiles have, if not more complex, at least a more highly organized mode of reproduction, more affected by cold. Many northern lizards and snakes, including the northernmost of all, manage to reproduce by becoming ovoviviparous: the female retains the eggs and "follows the sun" until they hatch. This is an adaptation for obtaining heat rather than for withstanding cold, and it emphasizes the fact that reptiles cannot reproduce in such cold places as amphibians.

As to habitat, water is a great buffer against cold. Fully aquatic animals such as fishes have an advantage in cold climates which is only partly shared by amphibians and is not shared by most reptiles. For some reason, this advantage seems not to hold within the classes. The most aquatic salamanders and frogs are not the most northern. Amphibious crocodiles and turtles do not range so far north as terrestrial lizards and snakes. But here is a curious fact. Of only 9 existing genera of crocodilians, one (*Alligator*) occurs in parts of both temperate Eurasia and temperate North America but nowhere in the tropics. Of 57 genera of non-marine turtles, one (*Emys*) is similarly Holarctic and another (*Clemmys*) is nearly so. But of about 600 genera of lizards and snakes, probably none has such a distribution; all well defined genera that are common to both halves of the north temperate zone occur also somewhere in

the tropics. One possible explanation of this fact is that amphibious crocodiles and turtles were formerly more successful than terrestrial reptiles in cool climates and that, although they are now archaic groups withdrawing into the tropics, fragments of their old north temperate fauna still persist. It may be significant that Colbert, Cowles, and Bogert (1946) find that individual American alligators have "surprising" tolerance for cold.

A general dominance is characteristic of northernmost amphibians and reptiles. The absolute northern limit of amphibians is set by the frog genus *Rana*, which is dominant in the tropics, but which ranges north of any primarily cold-adapted genus of frogs and north of all salamanders. Another great tropical genus of frogs, *Bufo*, ranges far northward too. The northernmost lizard genus, *Lacerta*, is dominant in north temperate Eurasia and occurs also in tropical Africa. Of snakes, the most northern genus, *Vipera*, is widely distributed in the Old World tropics; and the most northern oviparous snake belongs to the genus *Natrix*, which is dominant over much of the world, including the Old World tropics.

Several factors probably combine to determine the northern limit of any animal. For example, *Rana* would not reach the Arctic if it could not breed there, and it might not be able to breed there if its mode of reproduction were not the primitive one of the Amphibia. It might not be able to survive there if it were not itself amphibious, so that it could at times take advantage of water as a buffer against cold. And it probably would not have invaded the Arctic at all if it were not dominant elsewhere in the world.

To summarize the relation of dispersal to climate, I should say that dispersal of cold-blooded vertebrates has apparently been primarily from the tropics into temperate areas, but that the limits reached by different groups, and their success in cold places, have depended on many factors.

DISPERSAL BETWEEN OLD AND NEW WORLDS

Ancient tropical fresh-water fishes apparently moved from the Old World to South America; ameiurid catfishes, suckers, and cyprinids, from the Old World to North America; *Bufo*, *Rana*, brevicipitid frogs, and emydid turtles, from the Old World to North and South America. These are, as it were, straws all moving in one direction, from the Old World to the New. Straws often show which way a wind blows—does some wind blow these particular straws? I think one does. It is revealed when we turn from study of single families to analysis of whole faunas, especially the fauna of South America.

South America was an island during most of the Tertiary. Only near the beginning and again near the end of that period was the continent connected with the rest of the world so as to allow much exchange of land animals. This is proved by the history of mammals (Simpson, 1940a), and by other evidence. Existing families of amphibians and reptiles in South America fall into two fairly well defined groups (Table 8; cf. Schmidt, 1943, p. 252). One group, marked by much generic endemism, probably dates from the earlier connection; the other, marked by little or no generic endemism, probably dates from the later one.

The early South American fauna of amphibians and reptiles includes 19 families, *all* of which occur also in the Old World, except that the Teidae is represented there by the closely related Lacertidae; but there are additional families, old or diverse in the Old World, which are not represented in the early South American fauna: of frogs, the Ascaphidae, Discoglossidae, Pelobatidae (all old), and the Bufonidae, I nidae, and Rhacophoridae (diverse); of turtles, the Trionychidae (old and diverse); of lizards, the Chamaeleontidae and Varanidae (old) and the Scincidae and Agamidae (perhaps old, certainly diverse). Other smaller or more localized families peculiar to the Old World could be added to this list.

The late South American fauna of amphibians and reptiles includes 10 families not present in the early fauna. Of these, nine exist or are fossil in the old World; but there are additional families existing in the Old World which are not represented in the late South American fauna.

South American fresh-water fishes, it will be remembered (Table 5), include many endemic families, but the orders, and the main stocks within the orders, all occur in the Old World; and there are additional, significant stocks of fresh-water fishes in the Old World that are not in South America. It will be seen that the amphibians and reptiles fall into this same pattern, but at the level of families rather than that of higher groups. No family of amphibians or reptiles is peculiar to South America; most of the families in South America, including all the early ones, are represented in the Old World; and there are additional,

TABLE 8

South American families of amphibians and reptiles

Key: "x" indicates presence; "0", absence; "S", families that reach only the southern edge of temperate North America.

	ARRIVED		PRESENT IN OLD WORLD	IN TEMPERATE N. AMERICA
	Early	Late		
CAECILIANS				
Caeciliidae	x		Africa, Orient	0
SALAMANDERS				
Plethodontidae (*Oedipus* only)		x	Europe	x
FROGS				
Pipidae	x		Africa	0
Bufonidae (*Bufo* only)		x	Wide	x
Leptodactylidae	x		Australian Reg., South Africa, (fossil in India)	S
Atelopodidae	x		Orient	0
Hylidae	x		Temp. Eurasia, Australian Reg.	x
Ranidae (*Rana* only)		x	Wide	x
Brevicipitidae	x		Wide	x
CROCODILIANS				
Crocodilidae	x		Wide	x
TURTLES				
Chelydridae (*Chelydra* only)		x	(Fossil in Eurasia)	x
Kinosternidae (*Kinosternon* only)		x	0	x
Emydidae (*Geoemyda & Trachemys*)		x	Eurasia	x
Testudinidae (*Testudo* only)		x	Wide	x
Pelomedusidae	x		Africa, (fossil elsewhere)	(Fossil)
Chelyidae	x		Australian Reg., (prob. fossil in Orient)	0
LIZARDS				
Gekkonidae	x		Wide	x
Iguanidae	x		Madagascar, Fiji	x
Anguidae (2 genera)		x	N. temp. & Orient	x
Teidae	x		(Lacertidae)	x
Amphisbaenidae	x		Africa etc.	x
Scincidae (*Mabuya* only)		x	Wide	x
SNAKES				
Boidae	x		Wide	x
Typhlopidae	x		Wide	S
Leptotyphlopidae	x		Africa etc.	x
Anilidae	x		Orient	0
Colubridae (s. lat.)	x		Wide	x
Elapidae	x		Wide	x
Viperidae (3 genera)		x	Wide	x

significant families in the Old World that are not in South America.

The origin of the South American fauna will be discussed in more detail below. For the moment I wish to draw just one conclusion. Before or at the beginning of the Tertiary, immigrants representing some, but not all, contemporaneous Old World stocks of cold-blooded vertebrates somehow reached South America and persisted and radiated there. And toward the end of the Tertiary addi-

tional immigrants, again representing some but not all contemporaneous Old World stocks of amphibians and reptiles (and one or two stocks apparently endemic in North or Central America), reached South America across the existing land bridge. There seems only one reasonable explanation of all this. As between the Old World and South America, the Old World has been the principal center of evolution of great stocks of cold-blooded vertebrates, and the direction of their dispersal has been from the Old World to South America.

AREA, CLIMATE, AND EVOLUTION

If cold-blooded vertebrates have moved mostly from the tropics into temperate areas, and from the Old World to South America, then the main center of their evolution and dispersal has been the tropics of the Old World. Reasons can be found why this might be so.

Three kinds of evolution can be distinguished in theory, although they are probably mixed in fact and may be supplemented by additional minor processes. All three have the same principal mechanism: occurrence of mutations, and survival and spread of some mutations through populations. The first kind of evolution, ***differentiation of species***, is a process in which survival and spread of mutations may be partly random; it probably proceeds most rapidly in small, isolated populations. The second kind of evolution, ***adaptation to special environments***, is not random; mutations that happen to be advantageous under special conditions are selected. Rate of adaptation must vary with force of selection. When selection is so strong that advantageous mutations usually survive and spread, the rate of adaptation will vary with size of populations, for, other things being equal, size of populations determines the number of mutations that will probably occur. Of two otherwise identical populations, one with twice as many individuals as the other, the larger is twice as likely to originate any single mutation, and in processes that depend on an occurrence of series of different mutations the statistical advantage of the larger population is great. Size of populations depends partly on the area and continuity of the environments they inhabit. It follows that adaptation should be most rapid in environments that are extensive and more or less continuous. The third kind of evolution is ***general adaptation***. It includes all the improvements of organs and functions that allow some animals to live more efficiently than others in many environments, to react more rapidly or more intelligently, or to produce more offspring, or offspring that are more likely to survive. It is adaptation to the general environment of the world, and it should lead to general dominance, to success over great areas and in many special environments. Like special adaptation, it should be most rapid in the largest populations, which might be expected to exist where the general conditions of life are most favorable over the largest areas. For most cold-blooded vertebrates this is probably in the tropics of the Old World.

Both area and climate are involved in this conception. The large habitable area of the Old World tropics gives room for large populations. The favorable, stable climate of the tropics may sometimes favor dense populations, and probably allows a maximum number of generations of cold-blooded animals and so accelerates all kinds of evolution among them. Also, if general adaptation proceeds by continual radiation of few rather than by modification of many stocks, it should be most rapid where species are numerous as well as where populations are large. And the mere mass and diversity of life in large tropical areas may increase selective pressures and accelerate adaptation. The idea of evolution of dominant animals in great, densely populated areas is not new. It goes back to Darwin, although it has not been given sufficient attention by recent zoogeographers. I have merely restated the idea in terms of modern genetics.

Of course, the matter is not really so simple as this. Adaptation may be most rapid in populations that are not only large but that fluctuate violently or form many small, *partly* isolated subpopulations, which only occasionally interbreed. A more serious complication is that we do not know where the largest populations really are. It is often stated by naturalists that the old and stable tropics are inhabited by enormous numbers of species, which have small populations. My own experience of about five years in the tropics suggests that this is true, but that it is not the whole truth. If many rare species exist in the tropics, so do some common ones. But large populations occur also outside the tropics, perhaps especially in new or marginal areas. Some species of frogs and snakes are very common in great areas of northern North America, for example. Possibly the most rapid progressive evolution

occurs in short periods when great, new, *favorable* areas first become available to life, or when a stock first becomes able to spread into great areas that are new and favorable for it (cf. mammals, below). There is no use guessing further about this here. Whatever the details of the explanation, there is much evidence that the main center of evolution of dominant groups of fresh-water fishes, amphibians, and reptiles has in fact been the tropical part of the Old World, which is the largest favorable area for the existence of cold-blooded life. [Concerning population size and evolution, see Fisher (1930, p. 118), Dobzhansky (1914, Chapter 10), Simpson (1944, pp. 65–74), and Wright (papers cited by Simpson); concerning climate and evolution, see Muller (1942, p. 121); concerning rates of evolution, see Simpson (1944). I do not agree with Simpson that "mega-evolution," the origin of major families and orders, usually occurs in small populations. The origin of major groups of animals probably involves general adaptation, which might occur in a geologically short period of time, but probably requires large populations in large, favorable areas.]

The relation between special adaptation and general adaptation, leading to dominance, can be illustrated. Various snakes in many parts of the world are semi-aquatic, but three groups of them are more highly adapted than others to life in water, as they have valvular nostrils (Smith, 1943, pp. 17–19) and sometimes flattened tails. These groups are the Acrochordinae and Homalopsinae, fresh- and salt-water snakes derived from the Colubridae; and the Hydrophiidae, sea snakes, derived from the Elapidae. The three have originated independently, but all are confined to or center in the tropical Orient and islands to the south and east. Cyprinid fishes and probably emydid turtles did not acquire their aquatic adaptations in the Orient, but they have diversified there and apparently evolved there a dominance which has enabled them to spread widely. The tropical Orient is probably the only place where any land reptiles became fully aquatic during the Tertiary; and the Cyprinidae are the only fresh-water fishes and the Emydidae the only fresh-water turtles that became dominant and spread so extensively during the Tertiary. Perhaps marine catfishes should be added to the list of animals that have risen in the tropical Orient. One family of them, the Plotosidae, is confined to the Indo-Pacific region. The other, the Ariidae, occurs in warm seas around the world but is perhaps most recent in the Atlantic. It has re-entered fresh water in the Indo-Pacific region, but not in the West Indies. These catfishes are the only Ostariophysi and perhaps the only fishes that have successfully moved from fresh water into the sea recently. The convergence of the clues provided by all these groups of animals suggests that fresh-water and estuarine habitats were very extensive in the tropical Orient during the Tertiary and were inhabited by great populations of many animals, of which some became specially adapted to life in the water while others, already aquatic or amphibious, attained a general dominance that enabled them to spread over other parts of the world or to enter the sea.

The actual existence of dominance among animals is shown by observation of existing forms and in other ways. The fossil record shows many correlations of the rise of some groups with the disappearance of others, and the dominance of the ascendant groups has often been so great that no relicts of the others have survived. A bit of special evidence is that dominant genera of amphibians and reptiles range farther into the Arctic than specifically cold-adapted genera, as if the factors that make for dominance were stronger than long adaptation to cold. Finally, there is apparent direction in the dispersal of both plants and animals introduced into different parts of the world by man. Eurasian species tend to be successful in North America more than the reverse, and species from the larger continents tend to be successful in Australia and on islands. There are many individual exceptions, but the general direction of successful introduction seems to have been from larger to smaller land masses. The species of the larger land masses are usually dominant, as they should be, if what I have said about general adaptation is correct. Many of the introduced species are successful only in disturbed habitats, but other plants and animals, over longer periods of time, have spread naturally over the world, and it seems likely that they have shown the same order of dominance as the introduced forms, and have dispersed from large to small areas.

It is not clear whether introduced plants and animals have tended to move also from warm to cool climates. Movement in that direction is to be expected less among those plants and insects that are at home in cool places than among cold-

blooded vertebrates. Centers of evolution and dispersal of different groups probably vary with toleration for cold and with other factors. One might expect dominant stocks in each case to evolve in and to disperse from their most favorable and largest habitable areas.

A special case worth a moment's consideration is what would happen, theoretically, if a group of cold-blooded vertebrates became warm-blooded, as mammals and birds have done. They would become relatively independent of temperature, could cross climatic boundaries easily, and should be relatively successful in cold places. The area of evolution of dominant groups should then be extended northward, and might come to include not only the Old World tropics but the whole of the accessible north temperate zone. Warm-bloodedness might permit evolution of special processes. For example, more heat is apparently required for reproduction by reptiles than by amphibians, and still more heat plus control of temperature may be necessary for mammalian placental reproduction. But the most important effect of warm-bloodedness may be that, by opening areas of cool climate and by reducing the importance of local climatic barriers, it makes possible the existence of more, larger, and therefore more adaptable populations, and facilitates general adaptation. If so, warm-bloodedness may have allowed mammals not only to evolve a superior sort of reproduction but rapidly to become in every way better animals. This may have had something to do with the way they so abruptly replaced dinosaurs at the end of the Cretaceous.

Another and a very different thing, which tends to minimize barriers, increase the effective size of populations, and probably to facilitate general adaptation, is ability to fly. This fact may in part account for the dominance of insects and birds.

THE MAIN PATTERN OF DISPERSAL

The main pattern of dispersal of cold-blooded vertebrates is apparently evolution of dominant groups in the tropics of the Old World, and spreading of the dominant forms into less favorable climates and smaller areas. The spreading can occur along three chief routes (Figure 4).

A short route leads into temperate South Africa. Movement in this direction is from a more to a less favorable climate and from a larger to a smaller area. There are no great obstacles to dispersal in this direction except climate. Fresh-water fishes, frogs, and reptiles have all reached South Africa in some numbers, although there are many families of them in the African tropics that do not reach the south temperate zone. Most of the South African forms are not very different from those of tropical Africa. The most distinct South African group is an isolated genus of leptodactylid frogs. Frogs of the subfamily Brevicipitinae are confined to East and South Africa and may be retreating southwards, for the East African forms have discontinuous, relict ranges. Some groups, such as land turtles of the family Testudinidae and lizards of the African family Cordylidae (Zonuridae), are more diverse in south temperate than in tropical Africa, but they may be adapted to steppes and deserts more than to the south temperate climate.

A second route leads from the Orient to Australia and New Zealand This is also from larger to smaller areas and, in the southern hemisphere, from more to less favorable climates. The principal obstacle along this route is salt water, and cold-blooded vertebrates have dispersed apparently according to their powers of crossing it. Most fresh-water fishes stop at Java and Borneo, at the edge of the continental shelf of Asia. Ceratodontid lungfishes may be the only strictly fresh-water fishes that reached Australia even in ancient times, and even they may not have required continuous fresh water. So many existing fresh-water fishes are tolerant of salt water that we should not be dogmatic about ancient ones. Frogs have reached Australia several times and New Zealand once, but they have apparently done so with difficulty and at long intervals. The family that occurs in New Zealand no longer exists in Australia or the Orient. Leptodactylids and *Hyla*, which occur in Tasmania and temperate Australia as well as in tropical Australia and New Guinea, no longer exist in the Oriental Region, except that *Hyla* enters its northern edge. The brevicipitid frogs of New Guinea and tropical Australia form endemic subfamilies. Only the Ranidae are distributed and related as if they had reached the Australian Region recently. Of reptiles, *Sphenodon* is a unique relict. Its habits suggest that it may have reached New Zealand across an ocean barrier, and it has survived there, isolated from competition with most modern reptiles. It is an exception to the rule that reptiles in cool places develop rapidly, for its eggs take about a year to hatch. Perhaps failure to accelerate reproductive and developmental processes

contributed to the lack of dominance of the Rhynchocephalia. Non-marine turtles seem to have had trouble in reaching Australia, and they are not known to have reached New Zealand. The two families, Chelyidae and Carettochelyidae, that exist in the Australian Region have disappeared from the Orient, although both are apparently fossil there. Terrestrial *Testudo* has reached the Moluccas but not the Australian Region proper. Lizards seem to have reached Australia from the Orient easily and often: some genera are still common to the two regions. Two lizard families have reached New Zealand: the Gekkonidae are represented there by two endemic genera; the Scincidae, by about 9 endemic species of *Lygosoma*, a widely distributed genus which is abundant in the Orient and Australia but is absent in South America. Several aquatic and terrestrial snakes have reached Australia from the Orient more or less recently; again there are genera in common; but no snake has reached New Zealand.

The third route of dispersal from the Old World tropics follows an arc through temperate Eurasia and North America to tropical Central and South America. From the Old World tropics into temperate Eurasia is from a more to a less favorable climate and, for most cold-blooded vertebrates, from a larger to a smaller habitable area; both factors should favor dispersal northward. From temperate Eurasia to North America is from a larger to a smaller area; there is no great change of climate, but temperate Eurasian groups may carry a dominance evolved in the Old World tropics; the sum of factors should favor movement toward America. From North to Central America is again from a larger to a smaller area, but from a less to a more favorable climate; area should favor but climate oppose dispersal. From Central to South America involves no great change of climate but is from a smaller to a larger area, which should oppose dispersal. But dominance acquired in the Old World tropics may be carried through the

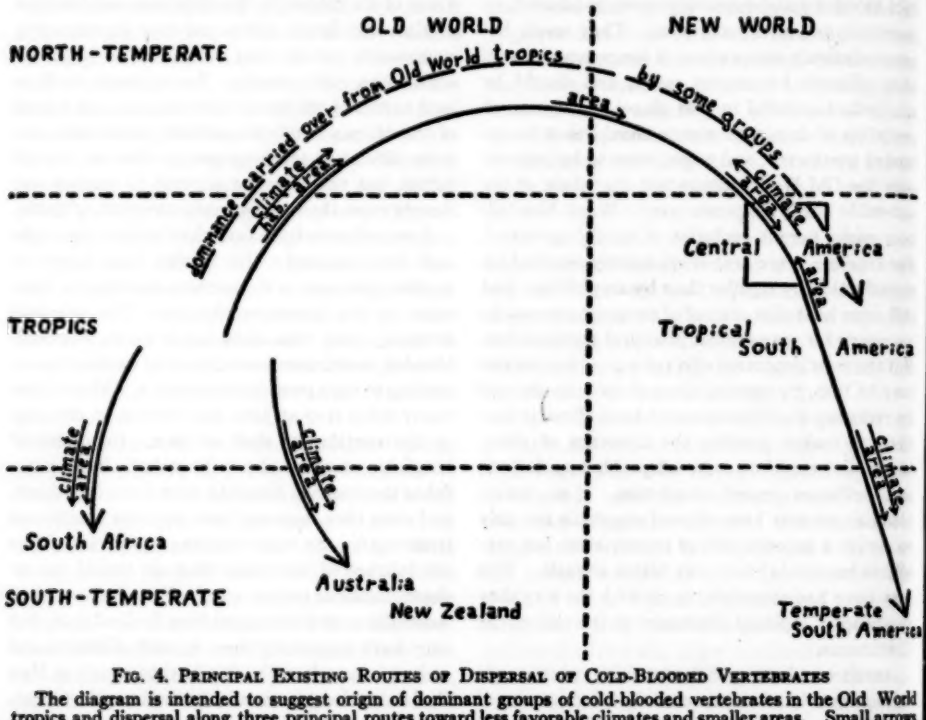

FIG. 4. PRINCIPAL EXISTING ROUTES OF DISPERSAL OF COLD-BLOODED VERTEBRATES

The diagram is intended to suggest origin of dominant groups of cold-blooded vertebrates in the Old World tropics and dispersal along three principal routes toward less favorable climates and smaller areas. Small arrows show the direction of effect of climate and area at critical points on the dispersal routes. See text for more detailed explanation.

north temperate zone and Central America to South America. Obviously, theoretical forces favoring dispersal decrease along this arc. Reverse movements might reasonable be supposed to occur locally, and probably have occurred: a sucker seems to have moved from North America back to the near corner of Asia; several groups of frogs and lizards are distributed as if they had moved from tropical America for varying distances into North America; and frogs of the genus *Hyla* may possibly have moved back from the American tropics through North America to temperate Eurasia. But, if the general theory is correct, it should be very rare for a group of cold-blooded vertebrates to follow the whole arc backwards and successfully repopulate the Old World tropics.

Different kinds of cold-blooded vertebrates should behave differently as they follow the arc from the Old World tropics through the north temperate zone to the American tropics. Strictly fresh-water fishes move slowly, from one drainage system to another, and are checked by relatively narrow barriers of salt water; they are tolerant of cold, occupy large areas in the north, and develop great northern faunas which may block dispersal of all except the most dominant of later tropical groups. Amphibians can disperse more rapidly, and apparently get across narrow salt-water barriers somewhat more readily; they are fairly tolerant of cold, and develop fairly distinct northern faunas. Reptiles can disperse still more rapidly, and get across narrow ocean gaps comparatively easily; they are less tolerant of cold, occupy smaller areas in the north, and do not develop persistent northern faunas likely to block dispersal of later tropical groups. These differences should be reflected in the faunas that accumulate at the end of the arc.

Central America has a cold-blooded vertebrate fauna which is significantly different from that of South America. South America has 21 families of primary-division fresh-water fishes. Eight of the families (4 of catfishes and 4 of characins) have gotten a slight hold in Panama or Panama and Costa Rica; but only 3 (additional) families range farther into Central America: gymnotid eels, to Guatemala; pimelodid catfishes and the Characidae, through Central America to southern Mexico and the Rio Grande respectively (Myers, 1938, p. 350). Of North American primary-division fishes, Central America has received only suckers and ameiurid catfishes, and these two families reach only Guatemala; and Central America entirely lacks peculiar primary-division families. Central America is, therefore, notably poor in strictly fresh-water fishes. But it has disproportionately many secondary-division, salt-tolerant fish of the Cyprinodontes and Cichlidae. Of amphibians, South America has 6 genera of caecilians, but only one occurs in Central America north of Panama (Dunn, 1942). South America has only one genus of salamanders, which is also the only genus in Central America. South America has 7 families of frogs and toads, of which all except the Pipidae are represented also in Central America; but of genera, Noble (1922, pp. 67–70) counts 60 in South America of which only 21 reach Central America, where only 4 genera are endemic. These exact figures would be challenged by more recent herpetologists, but the comparative lack of diversity of Central American frogs can hardly be questioned. But in reptiles the situation is very different. Schmidt (1943, p. 250) finds only 22 families of reptiles in South America, against 24 in Central America. The small area of Central America is therefore inhabited by more reptile families than the whole of the vastly larger and more varied South American continent; and many genera of reptiles are either confined to Central America or occur there but not in South America. So, as compared with South America, Central America has strikingly few fresh-water fishes except salt-tolerant ones; only a moderate number of amphibians; but many, diverse reptiles.

Central America may have been an island or a series of islands, isolated from North as well as from South America by ocean gaps, during part of the Tertiary. This may account for the predominance of fishes of salt-tolerant families, and in part for the diversity of reptiles, for many of the latter are notorious crossers of narrow salt-water barriers; but it hardly accounts for the presence in Central America of what appear to be both relict and immigrant groups of fresh-water turtles which, to judge from what we find in both the East and the West Indies, cross salt water less readily than frogs. But the theory that the Central American fauna owes its nature entirely to immigration across ocean gaps leaves unexplained something even more important. Of the few amphibians that have reached Central America recently from the north, all have pushed on into South America; of the many reptiles, few have entered South America. It looks as if amphibians, which disperse more

slowly and may be more delayed by barriers, and which have evolved cold-adapted, road-blocking northern faunas, have reached the American tropics only rarely, but always as dominant groups; while reptiles, which disperse more rapidly and are less delayed by barriers, at least of salt water, and which do not evolve road-blocking northern faunas, have filtered through the northern hemisphere comparatively often, but with varying dominance. Many have been able to enter and survive in the small area of Central America; fewer, to push into the larger area of tropical South America. This finding agrees strikingly with the expectation expressed above, and with Figure 4.

Phylogenetic (archaic) relicts occur in two sorts of places in the main dispersal pattern of cold-blooded vertebrates. Rarely, they are geographically isolated, outside the usual limits of distribution of their classes. There is one such case among fresh-water fishes (the lungfish in Australia), one among amphibians (the frog, actually 2 or 3 related species, on New Zealand), and one among reptiles (*Sphenodon* on New Zealand). What is not usually realized is that these cases are unique among cold-blooded vertebrates. There are some other cases of striking geographic isolation of species far from the present main areas of distribution of their families, but the isolated forms are not peculiarly archaic; they are geographic, not phylogenetic relicts. Most of the truly archaic forms actually occur in the largest, most stable, and (for each class) most habitable areas: the fresh-water fishes and the amphibians, in the tropics and the north temperate zone; the reptiles, centering on the tropics. The one sort of place in which archaic relicts rarely or never occur is in marginal, unstable or unfavorable, incompletely isolated areas. For example, no archaic type of reptile is peculiar to the north temperate zone, which is marginal for reptiles; and no archaic amphibian nor reptile is relict in Australia, which is probably marginal for them, less isolated than it is for fresh-water fishes or for mammals. Except for this general rule, there seems to be no definite relationship between the place of origin of a major group and the place where its last relict survives. The most striking relicts, the last survivors of great families and orders, are apparently in each case laws unto themselves as regards not only place but means of survival. Some survive by means of close adaptation to special environments; others, by competing more or less openly and successfully with great modern faunas; and a few, by reaching and persisting in very isolated places.

The distribution of primitive forms during the evolution and spread of dominant groups of animals is a problem which is related to, but not the same as, the distribution of archaic relicts. It is believed by some that the primitive forms stay at the dispersal center; by others, that they are forced to the periphery; but both beliefs probably oversimplify the problem. There are two kinds of peripheral areas: those that are peripheral because conditions there are less favorable than at the dispersal center, and those that are peripheral because they are distant from the dispersal center. And it is necessary to distinguish two kinds of spreading: the initial spread of a group of animals, and later waves of spreading of successive dominant elements within the group. In each case, it is the dominant elements which spread; they not only evolve and maintain themselves at the dispersal center but force their way into new territory at the expense of competing animals; but the patterns produced should be different. During the initial spread, dominant elements, numerous at the dispersal center, should be the *only* ones in all peripheral areas; non-dominant elements should occur only at the dispersal center. During the spread of later dominant elements (for example during the spread of the Cyprinidae, the latest dominant cypriniform fishes, from the Oriental tropics), the dominant elements are again numerous at the center; they may be relatively even more numerous in unfavorable-peripheral areas, where they may overwhelm almost all other competing forms (as the Cyprinidae seem to have done in temperate Eurasia); but they should be relatively few or absent in distant-peripheral areas. In such a case, the earlier, now non-dominant elements should be most numerous in distant-peripheral areas, perhaps still present in reduced numbers at the dispersal center, and least numerous or absent in unfavorable-peripheral areas. (This agrees well enough with the findings stated above about the final distribution of relicts.) It should be noted that the statement concerns *non-dominant* elements. It would hold for *primitive* elements only to the extent that they are the same as the nondominant ones; probably they often are the same, but perhaps sometimes they are not. It may be possible, as some taxonomists claim, to find the center of origin of a group of animals by

recognizing, and tracing the distribution of, the "primitive" forms, but the matter is not simple.

ANCIENT LAND BRIDGES AND ANCIENT CLIMATES

A land bridge exists between North and South America; intermittent bridges have surely joined Eurasia and North America; and an ancient bridge may have connected Asia and Australia. I want here to discuss some other, more hypothetical ancient bridges which are supported, or not supported, by evidence of the cold-blooded vertebrates.

South America was certainly connected with the rest of the world at or before the beginning of the Tertiary, but it is a question whether the connection was with North America. If so, the old fauna which came over it should in a general way resemble the new fauna which has come via North America.

The old South American fauna of amphibians and reptiles is derivable entirely from about 19 Old World families, as has been emphasized earlier. The new fauna includes 10 additional families, of which 9 exist or are fossil in the Old World; but the tenth (Kinosternidae) is confined to the Americas, and one or two others are much more North American than Old World in present distribution. The old fauna, then, apparently lacks a distinct North American element, while the new fauna has one. But the old fauna consists of groups that reached South America and survived there; the new one, of groups that have reached South America but have perhaps not settled the matter of survival. Many mammals entered South America in the Pliocene, but only a part of them survived; perhaps only part of the amphibians and reptiles will do so. But which part?

Of the new amphibians and reptiles, *Oedipus* and *Kinosternon* most obviously represent North or Central American groups. *Oedipus* is a genus of salamanders of the family Plethodontidae. The family may not actually have originated in North America, but it occurs chiefly there. *Oedipus* itself does not occur north of southern Mexico and is numerous in species in Central America, where it may have originated; from there it has spread south along the Andes through half the length of South America, but it has invaded South American lowlands very little. Two other amphibian genera seem to have reached South America recently: *Bufo* and *Rana*. I would predict that, if they compete, as salamanders and frogs may do, *Bufo* and *Rana*, which are dominant over much of the rest of the world, will survive in South America, and *Oedipus* will not. *Kinosternon* is a genus of freshwater turtles of the family Kinosternidae, a family of only three genera, of which two are confined to part of Central America. *Kinosternon* itself occurs from Central America north through much of eastern North America and south through the northern half of South America. Two other genera of freshwater turtles have invaded South America more or less recently and extensively. Both belong to the family Emydidae. I would predict that, if they compete, emydids, which are dominant in the Orient and North America, will survive in South America, and *Kinosternon* will not.

Perhaps in these cases distance and rate of dispersal should be stressed more than place of origin. The Plethodontidae, with one species relict in Europe, and the Kinosternidae, of unknown history, may have originated in the Old World, but if so they have dispersed so slowly that they have had time to recede there and to evolve peculiar stocks in North and Central America. These stocks were at the threshold when the door to South America was reopened, and they perhaps entered at once. *Bufo*, *Rana*, and the Emydidae have apparently dispersed from the Old World more rapidly and are still dominant there, and they have had less time to evolve in North and Central America. They have moved farther, or faster, than *Oedipus* or *Kinosternon*, and they may have arrived later, but they will probably be dominant in South America as elsewhere.

It is not necessary to discuss other cases. The new amphibian and reptile fauna which is accumulating in South America is of mixed origin, but the elements in it that are most likely to survive are dominant Old World stocks. The new fauna is reaching South America via North America, but it may eventually consist entirely of derivatives of a fraction of existing Old World families. So it seems that the old South American fauna of amphibians and reptiles may have arrived via North America too, although it now consists entirely of derivatives of a fraction of ancient Old World families. The question is, if the ancient immigrants reached South America from the Old World via North America, how much need North America have marked them? Perhaps not much, and the deepest marks may have been the soonest erased. That is, the most characteristic North American stocks may have been the least persistent in South America.

South American fresh-water fishes, too, are derivatives of a fraction of ancient Old World stocks. They have differentiated more than the amphibians and reptiles; either they have been in South America longer or they have evolved faster. I have tried, in preceding pages, to show how their ancestors might have filtered through the northern hemisphere from the tropics of the Old World. No strictly fresh-water fishes have reached South America recently, so there is no new fauna with which to compare the old one, but several facts are noteworthy.

Excepting salt-tolerant groups, the only fresh-water fishes that have entered present Central America are the Ostariophysi, but 13 ostariophysan families have done so. This probably illustrates the advantage of a dominant order in dispersal. Only two of the families, the suckers and the ameiurid catfishes, have entered from the north, and they have reached only Guatemala. Another northern ostariophysan family, the Cyprinidae, has reached southern Mexico. These three families are the only Ostariophysi in North America (excepting the two South American families that just reach its southern edge). They are probably all of Old World origin; the Cyprinidae may not have reached North America until the Miocene. But *all three* families have pushed farther south, toward or into Central America, than any other North American primary-division fishes. They show how dominant families of fresh-water fishes can spread from the Old World, and probably originally from the Old World tropics, through areas inhabited by old, temperate American families, and reach the edge of the American tropics; but all of them have spread widely in the north temperate part of America too. Eleven ostariophysan families have entered Central America from the south, and two of them have crossed the whole length of the existing land bridge to the southern edge of North America.

These facts suggest certain things. Ancient, tropical, fresh-water fishes may have moved through northern areas inhabited by north temperate fishes without displacing the latter: but if they did so, they probably either spread widely in the north temperate zone and will be found fossil there, probably in the Cretaceous, or they followed a route which was more open than now and more differentiated from the main north temperate zone, at least by climate. The present difficulty is in North America. Some tropical Oriental fresh-water fishes do push up through eastern Asia to the latitude of southern Alaska, and they might reach North America if a moderately warm Bering land bridge existed. Perhaps some ancient fishes did so, and perhaps they found an open route down western North America sometime before the Tertiary. They could probably have crossed a Central American land bridge like the present one, especially if there were no earlier dominant fishes in South America to oppose them. It may be that, during the Tertiary, South America has been a more favorable place for the evolution of dominant stocks of aquatic than of terrestrial vertebrates, and that the fresh-water fishes are more able than most of the rest of the fauna to defend themselves against the invasion of new stocks.

The old South American fauna of fresh-water fishes, the old one of amphibians and reptiles, and the new one of amphibians and reptiles agree in this: all consist or may come to consist of a fraction of Old World stocks that were or are contemporaneous. Since all are the same in this, they may all have been derived in the same way, from the Old World tropics by way of a cool northern filter bridge through temperate Eurasia and North America. I think, then, that at or before the beginning of the Tertiary South America was probably connected with North America, and that for existing cold-blooded vertebrates there is no need of any other old connection. This connection may be the most probable one geologically too. Geological forces in a zone between North and South America have made the new land bridge, and it seems likely that the same forces in the same zone made the earlier one. The question may be left to the geologists. Perhaps the joint science of paleontology will decide the matter. Simpson (1943, p. 420; 1940a, p. 154) finds paleontological evidence that *Testudo* and perhaps also certain mammals reached South America across the sea barrier during the continent's period of isolation. Perhaps it will be found that other animals trickled into South America throughout the Tertiary, and that they followed a persistent chain of islands which were remnants of an old bridge and are parts of the new one.

I have not forgotten the strength of the relationships that exist between parts of the faunas of South America and of Africa. All the strictly fresh-water fishes of South America may be derived from African groups; apparently none, from any North American group; not a single fossil has

yet been found in North America to prove the former presence there of any of the fishes concerned except the Osteoglossidae, which may have been salt-tolerant rather than strictly fresh-water forms; and enough other animals parallel the distribution of the fishes to make it unlikely that the latter's African-South American relationships are due to dispersal through the sea. Fresh-water animals that parallel the distribution of the fishes include not only pipid frogs and pelomedusid turtles but various fresh-water mollusks (Pilsbry and Bequaert, 1927, pp. 598–601). The fact of relationship of a part of the fauna of South America, especially the aquatic part, with that of Africa is beyond dispute. But there are two possible explanations of the fact. One is primarily geological: that great changes have occurred in the continents, and that Africa and South America were once somehow connected so as to allow a simple and direct exchange of life. The other is primarily biological: that geological changes have been slight, and that animals have evolved and spread and competed and receded in complex ways to produce the observed pattern. And whether this explanation is correct or not, dispersal of animals *has* been complex. I think it my function as a biologist to expound the biological explanation and to leave evaluation of the geological explanation to geologists. So throughout this paper I have tried to explain animal distribution in biological terms, without much reference to geology. For example, I have tried to show how Old World tropical fresh-water fishes might have filtered through the north temperate zone to South America (cf. Fig. 5), and I have described an exact route, through eastern Asia, western North America, and Central America; but I have not tried to decide whether this particular northern route is the one most likely to have been open to tropical fresh-water fishes in the late Cretaceous. That is something a geologist should decide. As to a direct connection between Africa and South America, it is my opinion that the biological evidence requires no such connection but does not necessarily forbid it.

In another part of the world, between southern South America and Australia by way of Antarctica or New Zealand, another ancient land connection is sometimes postulated. I shall not try to decide whether this connection really existed, but shall make some comments which concern it (cf. Simpson, 1940b).

The frogs (Leptodactylidae and *Hyla*) and turtles (Chelyidae) that are characteristic of both South America and Australia are all primarily tropical in distribution in South America; all except possibly the leptodactylids are as much tropical as temperate in the Australian Region; and all occur or are fossil somewhere in the northern hemisphere. All may reasonably be supposed to be tropical groups which have dispersed by northern routes.

The amphibians and reptiles of New Zealand are in no case intermediate between South American and Australian forms. New Zealand frogs and *Sphenodon* are not related to anything existing on either continent. New Zealand geckos are endemic genera of a chiefly tropical family. New Zealand skinks belong to a widely distributed genus which occurs in Australia but not in South America.

The only fresh-water fishes with wide Antarctic distributions are forms which enter the sea. The only terrestrial cold-blooded vertebrates with such a distribution are extinct meiolaniid turtles, which occurred in southern South America and in Australia, but which, judging both by analogy with *Testudo* and by occurrence of the meiolaniids themselves on islands, could probably cross sea barriers several hundred miles wide.

One may conclude that there is no good reason to think that any cold-blooded vertebrate has crossed an Antarctic land bridge, but that salt-tolerant fishes and giant land turtles may have dispersed across the water gaps of an Antarctic archipelago under conditions presumably more favorable than now.

Some groups of plants and insects have striking Antarctic distributions: they are common to south temperate South America, New Zealand, and Tasmania and southern Australia, and occur nowhere else. No vertebrates that are closely tied to the land have such distributions. This is sometimes taken to mean that the plants and insects crossed a very old Antarctic bridge before the origin of most existing vertebrates. I doubt, however, if age need be involved. Another explanation might be that plants and insects can persist in small, cold areas where vertebrates, especially cold-blooded ones, cannot. On Tierra del Fuego, for example, there are many Antarctic plants and insects, but no strictly fresh-water fishes at all, probably no amphibians, and only one genus of reptiles, *Liolaemus*, of the lizard family Iguanidae, a family

which is best developed in the tropics and which, incidentally, does not occur in the Australian Region or New Zealand. By whatever means plants and insects have reached Antarctic lands, the fact that they can persist there allows them special patterns of distribution. If some of them have dispersed from the Old World tropics, as I suppose cold-blooded vertebrates have done, they have been able to go farther south on the main dispersal lines and have reached and persisted in Antarctic areas.

FIG. 5. GEOGRAPHIC RELATIONSHIP OF AFRICA AND SOUTH AMERICA

This map is a double orthographic projection which shows the main land masses as if the earth were transparent. Solid lines show land on the near side and dotted lines land on the far side of the earth. The map is designed to show not only the relative positions on the globe of Africa and South America but also the position of the northern filter bridge which almost connects them. It emphasizes how high above the tropics animals have had to go to cross from the Old to the New World by a Bering land bridge.

Some of the plants and insects may have dispersed over ocean gaps across an Antarctic archipelago in times of favorable climate. This is a matter for study, not guessing. It calls for study of the sorts of plants and insects that reach oceanic islands, and for study of dispersal by wind as well as by ocean drift. Chances of wind dispersal cannot be understood without knowledge of the simple principles of air physics (cf. Darlington, 1938, pp. 278–282) and of the wind and storm systems of the world, including the high altitude winds which

blow in different directions and much faster than surface winds.

Concerning ancient climates I have only a little to say. The earth is and always has been a revolving sphere with an equator that receives much heat from the sun and poles that receive little, so the earth's climate must always have been somewhat zonal. Moreover, the earth's axis is inclined so that, as the earth passes around the sun, northern and southern lands have alternate warm and cold seasons which may be even more important than mean temperature in limiting some kinds of life. Within the main zones, climate varies especially with rainfall, which depends on local factors such as the distribution of land and water, the position of mountain ranges, and the direction of prevailing winds. Every existing continent is partly wet and partly dry, and every large continent has probably always been at least wetter in some parts than in others. So zoögeographers may assume some zoning of temperature and some differentiation of local climates at all periods of the earth's history with which they are concerned. Of course local climates have often changed, and even the main zones have varied in intensity and may have shifted position, although the striking differences between north temperate and tropical faunas of fresh-water fishes seem to have existed through the Tertiary and suggest that the zones have not shifted much in that period.

Several times in preceding pages I have mentioned Matthew's ideas (1915), and always to contradict them. I think that he accidentally misstated much of the evidence regarding the distribution of cold-blooded vertebrates and that he should not have tried to force them into his pattern of mammalian distribution. Also I question his theory of the effect of climate on evolution. But I agree with Schmidt (1943, p. 242) that Matthew's analysis of mammalian distribution was enormously important in counteracting a reckless building of land-bridges and in inaugurating a new, more critical, and more logical phase in the study of animal distribution. And I agree with Matthew himself that it is not necessary to remodel the world to account for vertebrate distribution.

CONCLUSIONS, APOLOGIA, AND PROBLEMS

At the beginning of this paper four questions were posed about the pattern of distribution of existing cold-blooded vertebrates. Now I shall try to answer the questions.

What is the main pattern of distribution? It is partly zonal and partly radial. The zonal elements follow the main climatic zones: freshwater fishes have great, distinct, tropical and north temperate faunas; amphibians, a great tropical fauna and another, less distinct north temperate one; reptiles, a great tropical fauna parts of which extend into the temperate zone, but no distinct north temperate fauna. The radial elements lie irregularly around the Old World tropics.

How has the pattern evolved? Some tropical and north temperate fresh-water fishes may have come independently from the sea. Some other zonal groups offer no clues to their histories. Where clues exist, dispersal seems to have been mainly from the Old World tropics. Apparently successive groups have risen in the Old World tropics, spread radially over much of the world, then fallen into the zonal pattern.

Why has the pattern evolved? Apparently (1) because great groups of animals rise to dominance in the largest and most favorable areas, which for cold-blooded vertebrates are in the tropics of the Old World, and disperse into less favorable climates and smaller areas, their dispersal being facilitated by the ability of dominant groups to enter cold and probably other inhospitable places; and (2) because, after they have dispersed, or during the dispersal of succeeding groups, the older groups tend to fall back into hospitable areas and to become differentiated by adaptation to the main climatic zones of the world.

What does the pattern tell us about ancient lands and climates? It tells of no extraordinary changes: only intermittent land connections between Eurasia and North America, between North and South America, and perhaps between Asia and Australia; and variation in intensity and detail, but not in orientation, of the main climatic zones. But it does not necessarily forbid other connections between continents. And the pattern of distribution of existing cold-blooded vertebrates probably tells nothing of the geography of the world before the later Cretaceous.

These answers have been reached by analyzing, separately, the distributions and apparent histories of fresh-water fishes, amphibians, and reptiles, and finding the common pattern. It was not until I had worked over the fishes and amphibians separately and repeatedly that I saw that there was a common pattern. In tracing the histories, I have tried to use fairly the clues discussed at the beginning of this paper, although space has not always been taken to specify each clue in each case. The

clues, of course, usually indicate apparent histories which are more or less probable but not proved. Perhaps this has not always been sufficiently emphasized. The main pattern of dispersal is an apparent one, derived from many probabilities. But the apparent pattern is common to fresh-water fishes, amphibians, and reptiles, and this fact perhaps strengthens the probabilities in each case.

Of course, the theory developed here is too simple No animals so old and so diverse as fresh-water fishes, amphibians, and reptiles are likely to have had a simple history of dispersal from one center. Different minor groups must have evolved in many different places and dispersed according to many factors, and dispersal must have involved inconceivably complex advances and retreats, which are considered here in the aggregate. The discussion of such special subjects as evolution and dominance has been drastically simplified too. Dispersal of successive dominant groups of cold-blooded vertebrates from a main center in the Old World tropics is just the outline of a pattern, with a minimum of details.

Many details of the distribution of important groups of animals are still unknown. Here may be mentioned a few that are overdue for attention. Some of these involve taxonomy. The so-called family Atelopodidae (Brachycephalidae) of frogs has been supposed to be confined to America, and was the only amphibian family that seemed to have originated and evolved entirely in the American tropics. Now Davis (1935) has found that an Oriental "*Bufo*" is really an atelopodid, and other Oriental and perhaps African species of this family may really exist. Zoögeographers will be indebted to whoever will compare skeletons of enough species to find out just where the Atelopodidae do occur and how they are related to the Bufonidae. Another case concerns possible relatives of the poisonous American lizards called Gila monsters. *Lanthanotus* of Borneo is usually placed with the Gila monsters in the family Helodermatidae, but it is not poisonous and it is a question how close the relationship really is. Another lizard, *Shinisaurus*, rather recently discovered and known only from the mountainous Yaoshan region of eastern Kwangsi in southern China, is now placed in a family by itself, but, as Loveridge has shown me, it resembles *Lanthanotus* and may be related to it. Both are large lizards, of about a foot in length, rather crocodile-like, with the crest of the tail double near the base. Both are very rare, and the Museum of Comparative Zoölogy is fortunate to have one specimen of each. Whoever can obtain sufficient material to compare the skeletons of these lizards and determine their relationships will make a real contribution to zoögeography. A more difficult problem is to determine the relationships of various groups of snakes, especially of subfamilies of the dominant Colubridae. The problem has been intelligently attacked (Dunn, 1928; Bogert, 1940; Smith, 1943), but not yet solved. In the meantime, the classification of snakes is partly artificial, and does not give a very sound basis for zoögeographic work There is in general a need for more and better taxonomic work, and for geographic summaries written by taxonomists. Too many specialists publish important checklists or revisions without such summaries. It would be easy for them to add brief, accurate statements of the geographical distributions of the groups they know so well May they do so more often in the future! It is hard for a person like myself to dig the information out of the masses of unfamiliar details. Tact forbids the selection of examples for criticism, but one may be cited for praise: Smith's new volumes on reptiles in *The Fauna of British India* include model summaries of the distributions of families and genera.

Some details that need attention are more geographic than taxonomic. The northern limits of various cold-blooded vertebrates in North America are astonishingly little known. Any records of amphibians and reptiles collected above 51° N. in northwestern North America and above 47° N. in the northeast are likely to be valuable. The southern limits of many South American groups are still to be defined, too. And the life histories of both northern and southern species need study.

In other cases the need is for summary or analysis of known facts. The genera and species of North American fresh-water fishes are fairly well known, but there is no good modern summary of their distribution The fish faunas of South America, Africa, and the Orient have all been better summarized and analysed than that of North America. Of amphibians and reptiles, the Central and South American faunas most need analysis.

Certain parts of the world are due for analysis of their whole faunas. Zoögeographers since Wallace have concentrated on the Indo-Australian Archipelago, with fruitful results. Now it should be Central America's turn. In Central America no less than in Indo-Australia, there are striking differ-

ences in the patterns of distribution of fresh-water fishes, amphibians, and reptiles, and undoubtedly also of mammals, birds, and invertebrates; and the composition and history of adjacent faunas is relatively well known. A thorough analysis of the fauna of Central America and of its history, and a comparison with surrounding faunas, may well yield results of even more importance to zoögeographers, evolutionists, and geologists than the study of the Indo-Australian fauna has done. *Biologia Centrali-Americana* attempted the task too soon. Dunn (1931) and Schmidt (1943) have made a good beginning toward the analysis of what is now known of Central American amphibians and reptiles, but still it is only a beginning.

Of lands that are still likely to yield new animals of zoögeographic importance, Borneo seems to come first. *Lanthanotus* occurs there. So does an *Ophisaurus*, the only anguid known to exist far within the Old World tropics. The discoglossid frog *Barbourula*, now known only from Busuanga Island north of Palawan in the Philippines, and the only known tropical member of its family, may one day be found in Bornean hill streams. If, by any chance, salamanders have existed in the Old World tropics, Borneo is the most likely place for a relict to have survived New Guinea probably has more undiscovered species and genera of cold-blooded vertebrates, but Borneo is the place to look for relicts that give clues to the histories of families. Of lands that are likely to yield fossils of zoögeographic importance, the tropical Orient is probably first; North America, second.

Certain anomalies of distribution have been disposed of in recent years Noble (1926) has shown that a supposed Siamese *Ambystoma* salamander and an Abyssinian *Hyla* probably do not exist; they were based on mislabeled American specimens. Myers and Carvalho (1945) have eliminated the supposed La Plata salamander; it apparently really came from California. Dunn (in letter) has seen the type of *Spelerpes infuscatus* Peters, supposed to be from Haiti, and has found it to be a specimen of the Mexican *Oedipus pennatulus* (Cope); so there is probably no salamander in the West Indies. Loveridge and Shreve (1947) find that the "New Guinea" snapping turtle is a presumable mislabeled specimen of the common North American snapper; so there is no New Guinea snapping turtle. Some other anomalies are still outstanding. Ahl described a *Hyla* from Java in 1926, apparently without realizing that the locality was surprising. Ahl was responsible for the "Abyssinian" *Hyla*. Is the "Javan" one another mistake? A salamander (*Pleurodeles waltl* Michahelles), a *Hyla* (*arborea meridionalis* Boettger), and an emydid turtle (*Clemmys leprosa* (Schweigger)) are all recorded from tropical West Africa south of the Sahara. All are European, and each represents an order or family which does not otherwise occur in the Ethiopian Region. Are the records errors? Or have the animals been introduced by man? Or are they really native in tropical West Africa? Another group of records which needs clarification is that of salamanders in Brazil, even at the mouth of the Amazon (Myers & Carvalho, 1945). *Oedipus* salamanders do occur in parts of the northern half of South America, but records for the Brazilian lowlands are few and not entirely satisfactory. Zoögeographers would like to know just what species occur where, for these salamanders are the only primarily northern, cold-blooded vertebrates which seem recently to have penetrated the tropics so deeply.

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LIST OF LITERATURE

Ahl. 1926. Neue Eidechsen und Amphibien. *Zool. Anz.*; 67: 186–192.

Ander, K. 1942. Die Insektenfauna des baltischen Bernsteins nebst damit verknüpften zoogeographischen Problemen. *Lunds Univ. Årsskrift.*, n.f., Avd. 2, 38 (4): 82 pp.

Berg, L. S. 1936. [The suborder Esocoidei.] *Bull. Inst. Rech. Biol. Perm*, 10: 385–391. [Russian; summary in English]

Bogert, C. M. 1940. Herpetological results of the Vernay Angola Expedition. . . I. Snakes, including an arrangement of African Colubridae. *Bull. Amer. Mus. nat. Hist.*, 77: 1–107.

Cameron, A. T., and others. 1947. North West Canadian fisheries surveys in 1944–1945. *Bull. Fish. Res. Bd. Can.*, No. 72: 94 pp.

Camp, C. L. 1923. Classification of the lizards. *Bull. Amer. Mus. nat. Hist.*, 48: 289–481.

Colbert, E. H., Cowles, R. B., and Bogert, C. M. 1946. Temperature tolerances in the American alligator and their bearing on the habits, evolu-

tion, and extinction of the dinosaurs. *Bull. Amer. Mus. nat. Hist.*, 86: 327–373.

DARLINGTON, P. J., JR. 1938. The origin of the fauna of the Greater Antilles, with discussion of dispersal of animals over water and through the air. *Quart. Rev. Biol.*, 13: 274–300.

DAVIS, D. D. 1935. A new generic and family position for *Bufo borbonica*. *Zool. Ser. Field Mus. nat. Hist.*, 20: 87–92.

DE BEAUFORT, L. F. 1913. Fishes of the eastern part of the Indo-Australian Archipelago, with remarks on its zoogeography. *Bijdr. Dierkunde, Amsterdam*, 19: 95–164.

DOBZHANSKY, T. 1941. *Genetics and the origin of species*. Second edition. Columbia Univ. Press, New York.

DUNN, E. R. 1925. The host-parasite method and the distribution of frogs. *Amer. Nat.*, 59: 370–375.

——. 1928. A tentative key and arrangement of the American genera of Colubridae. *Bull. Antivenin Inst. Amer.*, 2: 18–24.

——. 1931. The herpetological fauna of the Americas. *Copeia*, 1931: 106–119.

——. 1942. The American caecilians. *Bull. Mus. comp. Zool.*, 91: 439–540.

EIGENMANN, C. H. 1918. The Pygidiidae, a family of South American catfishes. *Mem. Carnegie Mus.* 7: 259–398.

EVERMANN, B. W., and GOLDSBOROUGH, E. L. 1907. The fishes of Alaska. *Bull. U. S. Bur. Fish.*, 26: 219–360.

FISHER, R. A. 1930. *The genetical theory of natural selection*. Clarendon Press, Oxford.

GILMORE, C. W. 1943. Fossil lizards of Mongolia. *Bull. Amer. Mus. nat. Hist.*, 81: 361–384.

HERRE, A. W. C. T. 1928. True fresh-water fishes of the Philippines. In *Distribution of life in the Philippines* (Dickerson, ed.), *Monogr. Bur. Sci., Manila*, 21: 242–247.

——. 1933. The fishes of Lake Lanao, a problem in evolution. *Amer. Nat.*, 67: 154–162.

INGER, R. F., and CLARK, P. J. 1943. Partition of the genus *Coluber*. *Copeia*, 1943: 141–145.

JORDAN, D. S., EVERMANN, B. W., and CLARK, H. W. 1930. Check list of the fishes and fishlike vertebrates of North and Middle America... *Rep. U.S. Comm. Fish.*, 1928, with appendixes, part 2: 1–670.

LOVERIDGE, A. 1942. Scientific results of a fourth expedition to forested areas in East and Central Africa IV. Reptiles. *Bull. Mus. comp. Zool.*, 91: 237–373.

——, and SHREVE, B. 1947. The "New Guinea" snapping turtle. *Copeia*, 1947: 120–123.

MATTHEW, W. D. 1915. Climate and evolution. *Ann. N. Y. Acad. Sci.*, 24: 171–318. [Reprinted, 1939, as *Special Publication, N. Y. Acad. Sci., 1.*]

METCALF, M. M. 1940. Further studies on the opalinid ciliate infusorians and their hosts. *Proc. U. S. natl. Mus.*, 87: 465–634.

MILLER, R. R. 1946. Distributional records for North American fishes... *J. Wash. Acad. Sci.*, 36: 206–212.

MOORE, J. A. 1942. The role of temperature in speciation of frogs. *Biol. Symp.*, 6: 189–213.

MULLER, H. J. 1942. Isolating mechanisms, evolution and temperature. *Biol. Symp.*, 6: 71–125.

MYERS, G. S. 1938. Fresh-water fishes and West Indian zoögeography. *Smithson. Inst. Publ.* 3465, from *Rept. for 1937:* 339–364.

——. 1940. The fish fauna of the Pacific Ocean,... *Proc. 6th. Pacific Sci. Cong.*, 3: 201–210.

——. 1943. Rediscovery of the Philippine discoglossid frog, *Barbourula busuangensis*. *Copeia*, 1943: 148–150.

MYERS, G. S., and CARVALHO, A. L. DE. 1945. Notes on some new or little-known Brazilian amphibians, with an examination of the history of the Plata salamander, *Ensatina platensis*. *Bol. Mus. nac. Brasil*, n. s., Zool., 35: 24 pp.

NICHOLS, J. T. 1928. Fishes from the White Nile collected by the Taylor Expedition of 1927 [with a tabulation of "the world's fresh-water fish faunae"]. *Amer. Mus. Novit.*, 319: 7 pp.

——. 1938. Classification of carp-like fishes. *Zoologica, N. Y.*, 23: 191–193.

——. 1943. The fresh-water fishes of China. *Nat. Hist. cent. Asia*, 9: xxxvi + 322 pp. *Amer. Mus. nat. Hist., N. Y.*

NOBLE, G. K. 1922. The phylogeny of the Salientia. I... *Bull. Amer. Mus. nat. Hist.*, 46: 1–87.

——. 1925. The evolution and dispersal of the frogs. *Amer. Nat.*, 59: 265–271.

——. 1926. An analysis of the remarkable cases of distribution among the Amphibia... *Amer. Mus. Novit.*, 212: 24 pp.

——. 1931. *The biology of the Amphibia*. McGraw-Hill, New York.

NORMAN, J. R. 1938. On the affinities of the Chilean fish, *Normanichthys crockeri* Clark. *Copeia*, 1938: 29–32.

PARKER, H. W. 1934. *A monograph of the frogs of the family Microhylidae*. British Mus. nat. Hist., London.

——. 1940. The Australasian frogs of the family Leptodactylidae. *Novit. Zool.*, 42: 1–106.

——. 1941. The caecilians of the Seychelles. *Ann. Mag. nat. Hist.* (ser. 11), 7: 1–17.

PILSBRY, H. A., and BEQUAERT, J. 1927. The aquatic mollusks of the Belgian Congo, with a geographical and ecological account of Congo malacology. *Bull. Amer. Mus. nat. Hist.*, 53: 69–602.

REGAN, C. T. 1905. A revision of the fishes of the family Galaxiidae. *Proc. zool. Soc. Lond.*, 1905 (2): 363–384.

——. 1922. The distribution of the fishes of the order Ostariophysi. *Bijdr. Dierkunde*, Amsterdam, 22: 203–208.

——. 1929. "Cyclostomata", "Selachians", and "Fishes". In *Encyclopaedia Britannica*, 14th edition.

ROMER, A. S. 1945. *Vertebrate paleontology*. Second edition. Univ. Chicago Press, Chicago.

SCHMIDT, K. P. 1943. Corollary and commentary for "Climate and Evolution." *Amer. Midland Nat.*, 30: 241–253.

——. 1944. Crocodiles. *Fauna* (Zoöl. Soc. Philadelphia), 6: 67–72.

——. 1946. On the zoögeography of the Holarctic Region. *Copeia*, 1946: 144–152.

SCHREIBER, E. 1912. *Herpetologia europaea*. Second edition. Jena.

SIMPSON, G. G. 1938. *Crossochelys*, Eocene horned turtle from Patagonia. *Bull. Amer. Mus. nat. Hist.*, 74: 221–254.

——. 1940a. Mammals and land bridges. *J. Wash. Acad. Sci.*, 30: 137–163.

——. 1940b. Antarctica as a faunal migration route. *Proc. 6th Pacific Sci. Congr.*, 2: 755–768.

——. 1943. Turtles and the origin of the fauna of Latin America. *Amer. J. Sci.*, 241: 413–429.

——. 1944. *Tempo and mode in evolution*. Columbia Univ. Press, New York.

SMITH, M. A. 1943. Serpentes. *The fauna of British India*, . . . Reptilia and Amphibia, 3: XII + 583 pp. Taylor & Francis, London.

STEPHENSON, N. G., and THOMAS, E. M. 1945. A note concerning the occurrence and life-history of *Leiopelma* Fitzinger. *Trans. Proc. R. Soc. N. Z.*, 75: 319–320.

TURBOTT, E. G. 1942. The distribution of the genus *Leiopelma* in New Zealand with a description of a new species. *Trans. Proc. R. Soc. N. Z.*, 71: 247–253.

WILLIS, J. C. 1922. *Age and area, a study in geographical distribution and origin of species*. Cambridge Univ. Press, Cambridge, Eng.

GERMPLASM, WEISMANN, AND HYDROZOA

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THE theory of the continuity of the germplasm, originated and developed by August Weismann during the last two decades of the nineteenth century, has had a pervading influence throughout biology. It has probably been considered to some degree by every biologist, although at the present time its impact differs greatly in the various fields. To many geneticists it still seems to have an odor of sanctity, to most embryologists it has an old-fashioned association with what are now regarded as problems or phenomena of development pure and simple, while many botanists are but vaguely aware that Weismann ever existed. These distinctions are important and reflect the relevance Weismann's theory seems to have as a philosophical concept to the three disciplines respectively. Thus according to the nature of the living material with which one is most familiar, the theory of germplasm continuity may appear to be obvious, plausible, doubtful, or even absurd. Perhaps some of the passion with which it is often upheld by geneticists comes from the suspicion that those who leave the safety of the germplasm fall into the heresy of Lamarckianism.

Strong attacks have at times been made upon the theory. Hargitt (1926), for example, concluded: "I believe biology would be greatly the gainer by dropping the germplasm idea entirely and permanently." Simkins (1923) has been equally condemnatory, but in spite of such efforts the theory always appears to regain strength, as shown by Everett's (1945) recent and ardent support. This vitality may of course flow from truth itself incorporated in the germplasm concept, or it may be a false vitality akin to the walking-dead habits of a Dracula. In either case there is need to re-examine the hypothesis in its original context, to relate its origin to earlier conceptions, for none stands alone, and to trace its later influences in order to understand the present conflict and if possible therefore to liberate the philosophical spirit of the idea from its mortal substratum.

According to Everett (1945), who expresses a contemporary opinion, Weismann's theory is primarily that there is a clear distinction between the soma and the germplasm, and "the idea that the germ cells early separate from the soma and are unique in that they are the only cells capable of bridging the gap between successive generations has come to be known as the 'germ-track' theory of Weismann. . . . Weismann based his theory upon his work on the Hydromedusae."

These ideas, the abstraction of soma and germplasm, the material basis of the germ-track, and the significance of the Hydromedusae, all merit close examination While Weismann's investigation of the sex cells in hydroids has been generally held to give substantial support to his theory, actually he himself in his classical work, *The Germ Plasm* (1892), cites it as the source and basis of the entire theory. Accordingly his *Die Entstehung der Sexualzellen bei den Hydromedusen* (1883) becomes the core of the whole argument.

Weismann, it must be remembered, was in his early twenties when Darwin's *Origin of Species* focussed the attention of the biological world, and it was dominant and exciting a few years later in Germany just when he was launching, a little late, on his career as a biologist He became an ardent believer in and supporter of the theory of natural selection, and later was enormously influenced by the more or less philosophical extensions made by his colleagues, namely, the idioplasm concept of Nägeli, and Haeckel's theory of recapitulation during development His own rather peculiar theory of evolution was primarily a combination of these three concepts, with subsequent speculation

It is with this outlook, then, that Weismann came to the study of hydroids, and there is little doubt that he read into his observations ideas that were in a sense already "in the air," for Nussbaum

(1880) was simultaneously developing an essentially similar, though more morphological, theory. In their own way, each of these biologists crystallized the current feeling of their time and cannot be said to have studied their subjects free of preconception The confusion is profound, for while they did not recognize their own community of interest, and in factWeismann strongly attempted to refute Nussbaum's conception, it is Nusbaum's form of the theory of germplasm segregation that has had the most influence, support, and defence, though always under the heading of Weismannism.

WEISMANN AND THE HYDROZOA

While Weismann's work on the hydroids is admitted by him and his followers to be the main support of his thesis, it has never been translated into English, and there are actually very few direct references to it by either his supporters or antagonists Consequently it is necessary to refer to this monograph in much greater detail than might otherwise be necessary.

The first important observation which Weismann made after examining some 35 species of hydroids is that there is a definite relation between the locations of the germ-site (Keimstätte), i.e., where the germ cells differentiate, and the status of the sexual generation. He classified the sexual forms into 6 stages exhibiting an increasing degree of morphological regression:

Stage I. Free-living medusa.
Stage II. Medusoid with radial canals but no marginal tentacles, usually without velum, sense organs, or mouth opening, and liberating gonads upon separation from the hydroid stock.
Stage III. Sessile medusoid, radial canal mostly absent or incomplete; subumbrella cavity present.
Stage IV. Sessile gonophore, wall still with endoderm lamella and two ectodermal layers but no canals and mouth opening; manubrium directly enclosed.
Stage V. Sessile gonophore whose wall consists of incomplete layers.
Stage VI. Sporosac, without any trace of medusoid structures.

Likewise, the distribution of the germ site was arranged into 6 stages with increasing order of centripetal shift, i.e., shift toward the proximal end of the colony.

Stage I. Germ site in the ectoderm of the manubrium.
Stage II. In entocodon.
Stage III. In endoderm of gonophore bud.
Stage IV. In endoderm of blastostyle.
Stage V. In coenosarc of lateral hydranth.
Stage VI. In coenosarc of main hydranth (Fig. 1).

It must be agreed that while an exact stage-to-stage correspondence does not necessarily hold, the parallelism between the degree of germ-site shift and that of morphological regression on the part of the sexual generation is quite obvious. The cause of this shift in germ site is interpreted by Weismann as an acceleration of sexual maturity.

As the transformation of the free-living medusa to the sessile sporosac is a matter of phylogenetic retrogression, Weismann immediately attaches phylogenetic significance to the shift of the germ-site. The state of germ-site in those species producing free medusae is taken as the starting point, because in them the medusae have undergone little regression, and their germ-site should most represent the primitive pattern. In nearly all tubularids with free medusa, Weismann finds the germ-site to be the ectoderm of the manubrium (Fig. 1, Stage I). From there on a tendency for precocious differentiation of germ cells prevails. Instead of differentiating after the manubrium is well established (in most cases even after the medusa is liberated from the polyp), the germ cells differentiate in the entocodon (or medusa bell) at a time when the medusoid is yet only a rudiment. This shift (Fig. 1, Stage II) is essentially one of time; the topography is not altered to any appreciable extent, because the inner layer of the entocodon, where the germ cells differentiate, will soon develop into the ectoderm of the manubrium. The further shift of germ site is thought to take place along one of two alternative lines: 1) the germ site is still confined to the ectoderm but retreats into the wall of the gonophore bud; or 2) the germ site is diverted from ectoderm to endoderm of the gonophore bud. Both procedures have been adopted by tubularids as well as by campanularids. Following up the second alternative, one gets Stage III (Fig. 1): the germ site now lies in the endoderm of the gonophore bud. Further intensification results in Stage IV (Fig. 1), for here the germ site pushes back to the endoderm of the blastostyle. Stage V (Fig. 1), with the germ site situated further back in the coenosarc of the lateral

hydranth, is a heterogeneous group with reference to germ layers, because germ cells may differentiate into either ectoderm or endoderm. Finally, is presumably descended from Stage II through adopting the first alternative and its subsequent intensification.

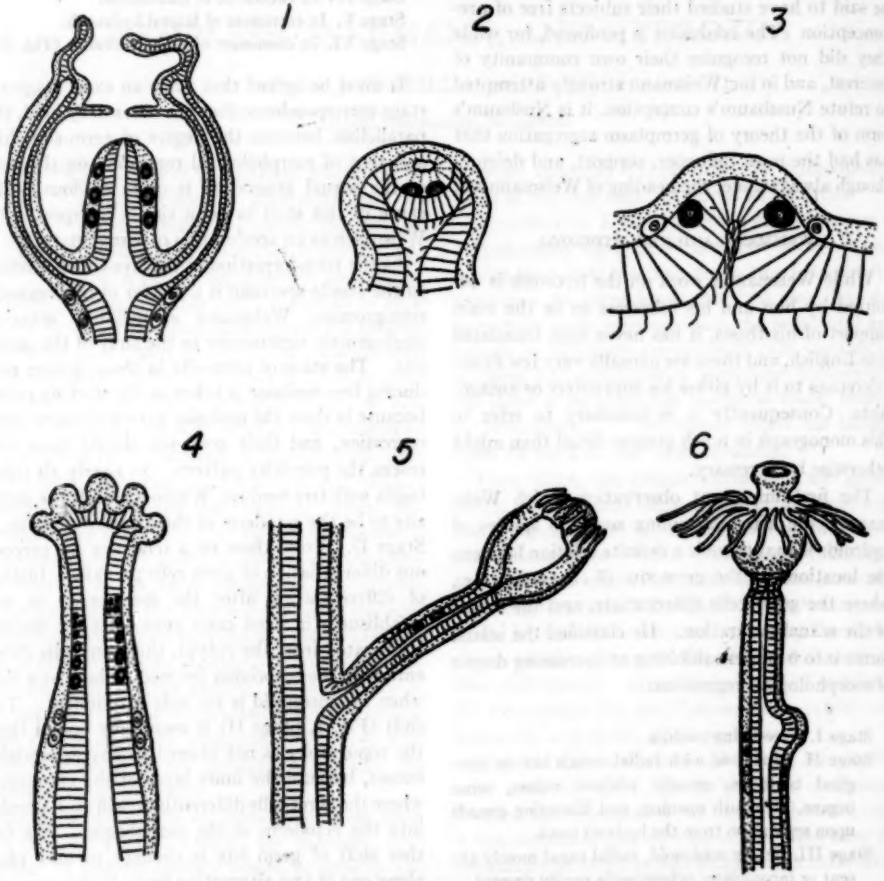

FIG. 1. SIX STAGES IN GERM-SITE SHIFT IN HYDROIDS, AFTER WEISMANN

Ectoderm is stippled, endoderm striated, germ-cells are oval, definitive germ cells black, hypothetical primary germ cells light. 1, Late stage in medusa development with definitive germ cells in ectoderm of manubrium. 2, Early stage in medusa development with the entocodon (or medusa bell) showing central bell cavity, and germ cells segregated within the entocodon. 3, Young stage in development of gonophore (or abortive medusa) with definitive germ cells in endodorm, supposedly having migrated from gonophore ectoderm. 4. A blastostyle, destined to give rise laterally to gonophores, with germ cells present in its wall before the onset of gonophore formation. 5, Germ cells shifted to stem of lateral branch. 6, Germ cells shifted to wall of main stem of hydranth.

the culmination of shift is reached in Stage VI (Fig. 1), where the germ site lies in the coenosarc of the main hydranth. Of all the species Weismann examined, only the female of *Eudendrium racemosum* attains this stage; since in this case the germ cell differentiates in the ectoderm, Stage VI

It should be commented here that while a precocious development of germ cells and a tendency of centripetal displacement of the germ site is an undeniable phenomenon in hydroids, the overemphasis upon phylogeny alone incurs unnecessary predicaments in explaining many facts which

Weismann confronted, among which the wide difference in germ site frequently occurring between the two sexes of the same species is but one. He interpreted this on the ground of functional utility on the part of the animal.

The significance of the germ-site shift as seen by Weismann, however, did not end here. It remained for two more important observations to complete its implications. The first observation consisted of two items:

1. The germ site is stably fixed at a certain place in a given species (or, in some cases, a given sex of that species). It never varies from one region to another, or one germ layer to another.
2. Histologically differentiated cells never transform into sex cells; only cells of embryonic character can give rise to germ cells.

Putting aside the question whether these two observations are correct or not (which Goette and Hargitt have disputed), it is surprising to see Weismann plunge into the immediate deduction that "not any cell can become a germ cell under certain circumstances, but only those cells that are determined to do so in previous cell generations can undergo this transformation" (W., 1883, p. 226). For this deduction in itself is the keynote of the theory of germinal continuity which he later formulated, in 1885.

The other important observation which Weismann made is that, in sharp contrast to the phylogenetic shift of the germ site, the place where the germ cells mature, the maturation site (Reifungstätte), is remarkably constant and coincides with the phylogenetically oldest germ site (Germ-site Stage I), i.e., the ectoderm of the manubrium. Even those species with most extensive shift of germ site nowadays still retain their maturation site in the ectoderm of the manubrium.

With (1) the deduction which he obtained from the first observation that only predetermined cells can form germ cells, (2) the fact that germ site varies with species and on the whole exhibits a tendency to centripetal shift, and (3) that the maturation site is nevertheless fixed at the ectoderm of the manubrium, Weismann visualized a migration of sex cells (including primordial germ cells and definitive germ cells) which is the most important theme of his monograph.

The method which Weismann used in constructing his theme is none other than to project phylogeny into ontogeny. In other words, he conceived the ontogenetic development of the sex cell to be a recapitulation of the evolutionary history. Since in those species with free medusae the ectoderm of the manubrium is at once the germ site and maturation site, he reasoned that the germ cell must have originated there (as primordial germ cell), differentiated there (as definitive germ cell), and matured there Despite that at the present time the germ site may have shifted to various extents, the primordial germ cell, in view of its predetermined nature, must still arise at the archaic position—in the ectoderm of the manubrium, or of the rudiment which is going to develop into the ectoderm of the manubrium—and it is on this ground that he maintained that the germ cells of hydroids should be always ectodermal in origin, no matter whether they differentiate in the ectoderm or in the endoderm.

Since the primordial germ cells have arisen from the ectoderm of the manubrium, they must have undergone a migration so that they could reach the new germ site where they are to differentiate into germ cells. This constitutes one phase of the migration. The other phase is the migration of the germ cells from the germ site to the maturation site; it seems that a migration of this kind is inevitable if the germ cell which has been differentiating at some other place is eventually to lie in the ectoderm of the manubrium, as already mentioned. The two phases of migration could be considered, therefore, as the efferent and afferent paths of the sex cells with reference to the definite maturation site. Accordingly, Weismann stated that there is no migration in species whose germ site is also the maturation site, as is the case with those giving free medusae. Nor is a migration to be expected in forms which have the germ site in the entocodon, such as *Tubularia* (W., 1883, p. 219), because the germ cell is driven to the final position simply by the formative force of the gonophore bud (W., 1883, p. 270). Once the shift of germ site carries beyond Stage II (Stages III, IV, and V), an active migration of the primordial germ cells becomes necessary, and in migrating they work their way through the mesolamella to reach their germ site, only to penetrate the mesolamella once again later on, this time as definitive germ cells, in order to return to the age-old site of maturation. Moreover, even in the case where the germ site shows an extensive shift yet is still confined within the ectoderm (Stage VI), the germ cells on their way back must nevertheless break

through the mesolamella twice, first entering and then quitting the endoderm, to reach the homologous layer of the ectoderm of manubrium.

As to identity of the primordial germ cells, Weismann indicated that they are a kind of embryonic cells which give rise to germ cells. He admitted, however, that there is no morphological distinction between the primordial germ cells on the one hand, and other embryonic cells on the other. The primordial germ cells therefore have no morphological characteristics of their own. What makes them primordial germ cells is that they, and only they, can give rise to germ cells. This criterion, however, is taken for granted by Weismann as the deduction of his two observations. It has been shown that this deduction is logically unsound, even if the premises be correct. The investigations of Goette (1907) and Hargitt (1919), furthermore, revealed facts which are incompatible with these premises. The presence in the hydroids of a kind of primordial germ cell, in the sense of Weismann, is therefore purely imaginary and not supported by evidence of any kind in his original paper.

As a proof of the migration of the supposed primordial germ cells, Weismann presented the evidence he found in *Podocoryne*, *Hydractinia*, and *Pachycordyle*. In *Podocoryne*, in the young gonophore not yet containing any egg or having only a very few small eggs, separate cells may be seen in the ectoderm, larger than the rest, with a somewhat large, light nucleus and a deeply stained nucleolus. Sometimes these cells are seen to be applied closely to the mesolamella. Similar cells, separate or in groups, may be found on the other side of the mesolamella, in the endoderm, thus indicating that they have migrated from the ectoderm. These cells later develop into eggs.

In *Hydractinia* as well as in *Podocoryne*, where Weismann made particularly detailed observations, neither in the female nor in the male does the germ cell originate through transformation of the differentiated endoderm cells. Since the endoderm could not form germ cells, and yet germ cells are formed in the endoderm of these species (female at least), they must have migrated from the ectoderm. In *Pachycordyle*, where the spermarium (only the male is known) is found to mature in the spadix (the maturation site is accordingly in endoderm and hence an exception to the general rule), cells similar to those constituting the spermarium are found in the ectoderm. Weismann considered this to be a strong morphological proof of a migration from the ectoderm.

Of this evidence, the first (from *Podocoryne*) and the third (from *Pachycordyle*) support the same line of argument, namely, the presence in the ectoderm of cells similar in appearance to the developing germ cells in the endoderm. When his original drawing of *Podocoryne* is consulted, it will be found that the ectoderm cell which he labels (*ekt'*) and states in the legend to be similar to the developing eggs in the endoderm bears little resemblance to the latter (W., 1883, Pl. 19, fig. 18), and to link them is rather far-fetched. The said ectoderm cell could well have been an interstitial cell. His drawing for *Pachycordyle* (W., 1883, Pl. 6, fig. 6) shows the primordial germ cell (*ukz*) similar to the developing male germ cell (*kz*) of the endoderm, but here the male germ cell shows resemblance to the ordinary ectoderm cell (*ekt*) just as well. It is obvious from his drawing that he was dealing with an interstitial cell again. Since interstitial cells have been reported to be present in both ectoderm and endoderm (Hargitt, 1919), the assumption of a migration becomes completely unnecessary.

The second evidence has been shown to rest on a false premise. Goette (1907) and Hargitt (1909, 1919) found numerous cases where division of an endoderm cell results in the formation of two cells, one of which becomes a germ cell while the other persists as an epithelial cell, thus supplying the facts demanded by Weismann himself, in the following words, to prove his contention incorrect:

"The egg in no case arises from accomplished endoderm cell; indeed, the cells from which the eggs differentiate lie long before at the depth of the endoderm which is otherwise single-layered. If the eggs were of endodermal origin, so they would have to arise from division of ordinary endoderm cells; and it would follow that, turning toward the gastrocoele, the distal half remains epithelial cell, the basal half becomes germ cell. Nothing has been proved of such division . . ." (W., 1883, p. 237).

"Such being the case, no explanation for the displacement of germ site from the ectoderm to the endoderm other than the one assumed before could exist, namely, a migration of the primordial germ cells from the ectoderm into the endoderm. In *Podocoryne* the male germ site today lies in the ectoderm of the manubrium; the female, however, in the endoderm of the gonophore bud. When once it is established that the latter position is derived from the former, how otherwise could one explain that suddenly cells of endodorm took over the functions which previously were possessed by

those ectoderm cells? It would be a different matter if in some species it occurred that germ cells differentiate at indiscriminate places in the stalk, now in ectoderm, now in endoderm. But this never occurs; of all the data communicated above it is evident that the germ site of present-day species is rigidly localized, and what else can this mean other than that certain cell generations alone possess the ability to produce sex cells, that a strict law of heredity governs here and nothing is arbitrary and accidental? How, then, under such circumstances could the endoderm cells of a gonophore bud take over the inherited properties of the ectoderm cells of the same bud? A long series of cell generations separates two cells, one of which originated from ectoderm cells, the other from endoderm cells lying on the other side of the mesolamella; they are connected only at the root of the whole polyp stalk; in other words, in the cleavage process of the egg, from which the first hydranth and colony originate. How and whereby could it become possible that suddenly the endoderm cell should differentiate into sex cells as the ectoderm cell has hitherto done? It is no exaggeration to regard this as impossible. When certain cells of the endoderm of the gonophore bud show the ability to differentiate into germ cells, the conclusion is undeniable that they must have migrated from the ectoderm, whether this be confirmed by observation or not." (W., 1883, p. 288).

In the above passage we can see that the basis for such an idea of migration is the supposed ectodermal origin of the primordial germ cells, an idea which in turn is based on the doctrine of recapitulation, in its original form now greatly discredited (DeBeer, 1940). But it is primarily on the basis of strict recapitulation that Weismann propounded the migration of primordial germ cells, to which he so stubbornly adhered that he seemed to have defended it to the extent of disregarding the truth. His interpretation of the germ cell origin of *Coryne* (W., 1883, p. 238) serves to illustrate how far imagination can be pushed to suit a preconceived idea. In this hydroid the germ cells arise from the entocodon, which he observed. In contrast to the entocodon of most hydroids, that of this genus is formed of endoderm instead of ectoderm, which he also admitted. However, he contended that the endodermal entocodon of *Coryne* must have descended from the phyletically old ectodermal entocodon, because *Syncoryne* is the nearest relative of *Coryne*, and it has the usual ectodermal entocodon. His interpretation of the formation of this endodermal entocodon was that, in this case, not only the primordial germ cells but all cells which would normally constitute the entocodon have become detached from the ectoderm together and have invaded the endoderm, only to rebuild there an entocodon just like the true ectodermal one (W., 1883, p. 238).

Both the preconceptions of migratory germ cells and primary segregations of germ sites have persisted for more than half a century, profoundly influencing the ideas and interpretations of subsequent workers. Recently, for example, Dupont (1942) has described the origin of germ cells in the hydroid *Tubularia* as follows. The entocodon is of ectodermal origin but sinks to form an ectodermal subumbrellar mass upon the underlying endodermis. The germ cells, also ectodermal, have an origin independent of the entocodon, and arise from interstitial cells that glide across the mesogloea into the endoderm in a sudden and fleeting movement and scatter among the bases of the endodermal cells. They then leave the endoderm and concentrate beneath the subumbrellar layer of the entocodon, without however penetrating into it. This, in our opinion, is a highly erroneous account, obviously inspired by Weismannian preconceptions, and with nothing in common with the much simpler and observable sequence of events described elsewhere for this same species (Liu and Berrill, 1948).

Weismann himself went on to say that "a given germ cell of the coenosarc migrates only to a determined gonophore," that each individual germ cell acts as an independent being which "strives for a definite aim," and exhibits "historical reminiscence" (W., 1883, p. 290). Paradoxically, however, he made it very clear that the germ cells of the hydroids arise late in their life cycle, as descendants of ordinary young tissue cells, and in no case are special cells set apart in early embryonic stages for that purpose (W., 1883, p. 279). He himself also refuted the idea of Nussbaum (1880), who maintained that germ cells are separated from the remaining cells in a very early stage before any histological differentiation takes place, a view which Weismann's over-enthusiastic followers have nevertheless tried to defend in vain.

Weismann's negation of Nussbaum's idea only made the issue more subtle. For basically, he and Nussbaum believed in the same principle, that there is a fundamental difference between the "sex molecule" on the one hand and the "somatic molecule" on the other hand. The discrepancy in their views only relates to the time for the expression of the "sex molecule." While Nussbaum contended

for the early separation and consequently absolute independence of sex cells as the germ layer, Weismann contested that the sex molecule may mix with soma for a long time before it splits off as the germ layer. Since on this view the sex molecule could occur in a diffuse state and intermingle with the soma, the same principle is rendered much less vulnerable to attack in Weismann's version than in Nussbaum's. As to why the sex molecule should lie diffuse in the somatic cells for a considerable number of cell generations, Weismann suggested that a general advantage of this kind is to enhance the propagative capacity of the individual which arises from the fertilized egg. In animals with alternation of generations this advantage is especially apparent, inasmuch as numerous individuals can be brought forth from a single egg.

Such, in broad outline, was Weismann's investigation of the sex cells of the hydroids. An analysis reveals that he had leaned overmuch upon the theory of recapitulation, and had too few facts to warrant his conclusions. Supposition upon supposition makes up the hypothesis of germ-site shift, which was then taken as evidence for his theme in his subsequent work (Weismann, 1892, p. 189).

While it is primarily Weismann's concept that there is a fundamental distinction between germplasm and soma, it is due mainly to Nussbaum that this separation has come to imply an actual segregation of the two types of tissue at an extremely early developmental stage, and also to the spectacular factual support by the description of germ-cell segregation in *Ascaris* (Boveri, 1899). Many similar cases, though rarely so extreme, have been discovered, but they are few in number compared with those organisms that exhibit no obvious segregation. The weight of authority, however, of the Weismann - Nussbaum combination convinced many later workers of the existence of facts they could not observe, and much subsequent argument has arisen over the identity of so-called primordial germ cells and the existence of a germ-track in developmental stages younger than those in which germ cells can be safely recognized. Two misconceptions have frequently arisen, that a cell must be a germ cell because of theoretical requirements in spite of contrary or ambiguous histological evidence, and that in organisms that produce asexually a series of non-sexual, sexually immature, and finally mature sexual forms, the germ cells migrate from one generation to the next, becoming progressively more mature with each migration.

In many cases, for example, the origin of the germ cells in hydrozoa has been traced back to the interstitial cells (Wülfert, 1902; Harm, 1902; Downing, 1905; Brien, 1942). But once the primordial germ cell merges its identity with the interstitial cell, any argument about a germ-track or about the nature of the primordial germ cell becomes futile. Since an interstitial cell can give rise to many different types of cell besides the germ cell, it is always in doubt whether the cell is a presumptive germ cell or something else. Identification of certain interstitial cells as primoridal germ cells has already been judged to be subjective and unwarranted (Wager, 1909; Tannreuther, 1909), although recently Brien (1942) claims both identity and migration in the case of *Clava*. In fact the whole question of interstitial cells and their significance in the Hydrozoa merits an intensive review and reinvestigation, and there is little doubt that their role has been grossly overestimated.

A good example of the other type of illusion is afforded by Pizon's (1893) monographic account of blastogenesis in *Botryllus*. In the early bud generations no gonads are visible, in later ones small immature ova are to be seen, while in large colonies the buds carry ova that grow and mature to become viable eggs. Believing was seeing, and since the germ track was known to exist in consequence of Weismann's and Nussbaum's authority, germ cells were present but unrecognisable in the oozoid, and passed from one bud generation to another until they became discernible and finally matured. This was a completely erroneous description, for each bud develops its own gonads to whatever extent is permitted by the initial size of the bud (Berrill, 1941).

The germ track, in fact, became a morphological concept that has distracted many workers from looking at phenomena as they are, misdirecting them from the basic problem of precocious histogenesis and induction that is so well presented by developing gonads. To indoctrinated sophisticates the monumentally simple or obvious, always difficult to see, becomes unnecessarily obscure, for "except ye be as little children, ye shall in no wise enter the kingdom of heaven."

Should the idea of germplasm be discarded even by those to whom the intellectual or emotional appeal is intense? To a considerable extent it is a matter of definition. It should be remembered

that the concept was developed at a time when eggs alone were seriously considered as the source of new organisms, and when the modern genetical understanding of nuclear constitution was a thing of the future. Most, if not all, of the controversy comes from the identification of the germ cells as the bearers of heredity, and the consequent significance of the continuity of the germ line through successive generations. This continuity is no longer of vital importance and a moderate shift in emphasis makes it possible to avoid the whole issue.

The change in point of view is a double one. The germ cells, and the ova especially, are highly developed and to some extent specialized cells elaborated primarily in connection with the mechanics or physiology of development, and not as bearers of heredity, although they have become so exploited. As a sacred image remote from the somatic multitude they have little meaning. On the other hand, the significance of the unspecialized cell whose descendants can become eggs or nematocysts in the case of hydroids, and nerve cells or spermatozoa in ascidians, becomes greatly enhanced. Among invertebrates and lower vertebrates where tissue and cell specialization is less extreme, tissues consisting of unspecialized cells in epithelial formation abound, and regeneration experments of the past several decades have shown that such cells are usually totipotent, having the innate capacity to give rise to any specialized tissue, including the gonads themselves. In other words the germplasm, if there be need for this abstraction, may be identified with any cell or cells that have not become specialized to any significant degree, cells with complete and unmodified nuclear constitution and with cytoplasm not so specialized either structurally or chemically as to be limited in its potentialities. Such cells may be large and highly elaborated in a general way, like the endodermal cells of hydroids, or may be small and little developed, as in the septal cells of annelids. In a more striking form they are found throughout the plant kingdom where most green cells with their cellulose wall, large vacuole and complex chloroplast, can under certain circumstances give rise to the complete plant. It is no wonder that germ site, track, and plasm are here alien sounds from a forgotten past.

We may end with reference to the most recently published account of germ cell origin in hydroids, that of Brien (1943). He concludes by stating that "l'évolution du germen en soma est reversible. De plus la lignée germinale est discontinué. . . . Il n'y a pas de dualité chez un metazoaire. L'organisme metazoaire est un tout en ses fonctions et ses structures." Germplasm, if the term is to be kept at all, can therefore be retained only as a pure abstraction, philosophically valuable but otherwise distracting. In our opinion it is better to dispense with it altogether than to continue to encourage its misuse.

CONCLUSION

In conclusion, Weismann undoubtedly had great insight into certain major problems of his day and in boldly challenging the Lamarckian principle and Darwin's related theory of pangenesis did much to bring the study of heredity into closer relationship with cytological research; and in emphasizing inheritance as the descent from a pre-existing germ cell and not from the parental body as a whole, he cleared the ground for the rise of genetics a decade or so later. His distinction between "germplasm" and "somatoplasm," while drawn much too sharply and in our opinion misleading, was a logical outcome of his belief in qualitative nuclear division as the primary determination of development of the egg.

Most embryologists now believe that fundamentally any cell may be totipotent, and contain the heritage of the species, and that limitations of potency are due to secondary inhibitory conditions. Though the trail of descent is still from zygote to zygote, it is in each generation broken through a short or long path of somatic cells. Germplasm becomes the essentially unmodified cell of the species, and the female germ cell is only one example, even though the type carrying the main burden. In recognizing the significance of the cell in inheritance, the concept remains philosophically important, but in confusing the abstraction with the morphological germ cell Weismann, and his followers especially, have created unnecessary difficulties. Our main criticism however remains, that ideas which Weismann arrived at intuitively or by induction from various sources, blinded him in his studies of hydroids and caused him to see imaginary migrations of visible and invisible germ cells, and that whatever the intrinsic merit of his ideas, they are not based upon the study to which they are credited.

LIST OF LITERATURE

BERRILL, N. J. 1941. Size and morphogenesis in the bud of *Botryllus*. *Biol. Bull.*, 80: 185–193.

BRIEN, P. 1942. Études sur deux hydroides gymnoblastiques, *Cladonema radiatum* (Duj) et *Clava squamata* (O. F. Müller). *Mem. Acad. Roy. Belg.*, 20: 1–116.

——. 1943. Études de la régénération et de la rénovation de l'appareil sexuel chez les Hydroides (*Clava squamata* O. F. Müller). *Arch. Biol.*, 54: 409–475.

BOVERI, T. 1899. Die Entwicklung von *Ascaris megalocephala* mit besonderer Rücksicht auf die Kernverthältnisse. *Festsch. Kupffer.*, Jena.

DE BEER, G. R. 1940. *Embryos and Ancestors*. Oxford Univ. Press, London.

DOWNING, E. R. 1905. The spermatogenesis of *Hydra*. *Zool. Jahrb., Abt. Anat.*, 21: 379–426.

DUPONT, M. 1942. Origin des cellules germinales et formation du gonophore chez les Tubulaires. *Arch. Biol.*, 53: 493–511.

EVERETT, N. B. 1945. The present status of the germ-cell problem in vertebrates. *Biol. Rev.*, 20: 45–55.

GOETTE, A. 1907. Vergleichende Entwicklungsgeschichte der Geschlectsindividuen der Hydropolypen. *Z. wiss. Zool.*, 87: 1–335.

HARGITT, G. T. 1909. Maturation, fertilization and segmentation of Pennaria tiarella and of Tubularia crocea. *Bull. Mus. comp. Anat. Harvard*, 53: 161–212.

——. 1919. Germ cells of coelenterates. II. General consideration, discussion, conclusion. *J. Morph.*, 33: 1–59.

——. 1926. The formation of the sex glands and germ cells of mammals. *J. Morph.*, 42: 253–294.

HARM, K. 1909. Die Entwicklungsgeschichte von *Clava squamata*. *Z. wiss. Zool.*, 73: 115–165.

LIU, C. K., and N. J. BERRILL. 1948. Gonophore formation and germ cell origin in *Tubularia*. *J. Morph.*, (in press).

NUSSBAUM, M. 1880. Zur Differenzierung des Geschlechts im Tierreich. *Arch. mikr. Anat.*, 18: 1–121.

PIZON, A. 1893. Histoire de la blastogénèse chez les Botryllidés. *Ann. Sci. nat.*, (7) Zool., 14: 1–386.

SIMKINS, C. S. 1923. On the origin and migration of the so-called primordial germ cells in the mouse and the rat. *Acta Zool.*, 4: 241–284.

TANNREUTHER, G. W. 1909. Observations on the germ cells of *Hydra*. *Biol. Bull.*, 16: 205–209.

WAGER, H. E. 1909. The oogenesis and early development of *Hydra*. *Biol. Bull.*, 18: 1–38.

WEISMANN, A. 1883. *Die Entstehung der Sexualzellen bei den Hydromedusen*. Gustav Fischer, Jena.

——. 1892. *The germ plasm*. English translation by W. N. Parker and H. Rönnfeldt. Scribners, New York.

WÜLFERT, J. 1902. Die Embryonalentwicklung von *Gonothyraea loveni*. *Z. wiss. Zool.*, 71: 296–327.

NEW BIOLOGICAL BOOKS

The aim of this department is to give the reader brief indications of the character, the content, and the value of new books in the various fields of Biology. In addition there will occasionally appear one longer critical review of a book of special significance. Authors and publishers of biological books should bear in mind that THE QUARTERLY REVIEW OF BIOLOGY *can notice in this department only such books as come to the office of the editor. The absence of a book, therefore, from the following and subsequent lists only means that we have not received it. All material for notice in this department should be addressed to H. B. Glass, Assistant Editor of* THE QUARTERLY REVIEW OF BIOLOGY, *Department of Biology, The Johns Hopkins University, Baltimore 18, Maryland, U. S. A.*

REVIEWS AND BRIEF NOTICES

GENERAL BIOLOGY: PHILOSOPHY AND EDUCATION

ON UNDERSTANDING SCIENCE: *An Historical Approach. The Terry Lectures.*

By James B. Conant. Yale University Press, New Haven; Geoffrey Cumberlege, Oxford University Press, London. $2.00. xvi + 145 pp.; text ill. 1947.

This book calls to mind another written long ago, at a turning point in the teaching of medicine in this country. Conant's book lacks the massive documentation of Abraham Flexner's famous report on *Medical Education in the United States*, but it promises to be equally influential. It is equally packed with radical ideas and searching criticisms, in this instance ideas concerning the usual approach to the teaching of science qua science. Again like Flexner's report, this volume appears at a time when change is in the air. It is a part of the scholastic ferment that has resulted in the Harvard Report, the various "Great Books" programs, and other such manifestations.

In the words of Conant himself, "the fundamental premise of this book" is that for the prevalent bewilderment about the nature of science "the remedy does not lie in greater dissemination of scientific information among nonscientists. Being well informed about science is not the same thing as understanding science, though the two propositions are not antithetical. What is needed are methods for imparting some knowledge of the Tactics and Strategy of Science."

In his first chapter, Conant develops this basic premise with arguments at once powerful and persuasive. This is not to say that no one will take exception to any of the statements made there, but the main contentions will carry a large measure of conviction. Expecially will this be true among those biologists who have heard otherwise mature students talking about science as though it were a revealed religion to be accepted and learned, or who have looked into elementary textbooks and laboratory manuals that are primarily compilations of didactic laws and compacted facts. Conant leaves little doubt that such things are part of science but not the core. "To give a better understanding of science," he says, "to those of our graduates who are to be lawyers, writers, teachers, politicians, public servants, and businessmen," it is not enough to present an array of discoveries in nuclear physics, biochemistry, or astronomy, however recent and dazzling. Nor is the dissection of one more animal nor the carrying out of one more experiment in chemistry the answer. Still less is it the most perfect presentation of the most perfectly

organized science complete and rounded from the all-inclusive law down to the smallest fact. On the contrary, it is the contention here that emphasis should be upon those features that distinguish science from dogma and give to science its unique power.

To implement his proposal, Conant suggests a special course built around the "case method" long in successful use in law schools and schools of military tactics and strategy. The second chapter is devoted to a detailed consideration of the 17th century investigations into air pumps, barometers, and vacua by Galileo, Torricelli, von Guericke, and Boyle, as illustrations of four principles of scientific discovery. Not only are the successes discussed, but also the errors made and difficulties met, the blind alleys and pitfalls, all of which are equally important from the point of view of such a course. The chapter ends with a brief but suggestive section on the interrelationships between science and society. The proposed study of Puritan Oxford and Catholic Florence as two contemporary centers of important scientific advance should be good medicine for the man liable to slip into easy generalization in this important field wherein everyone has opinions.

The third chapter deals with two case histories drawn from the 18th century, the discovery of the electric battery, and the chemical revolution which replaced the phlogiston theory of combustion by an even more fruitful theory. Numerous additional principles of scientific discovery are illustrated and discussed. The book closes with a brief chapter in which twenty-one "principles of the Tactics and Strategy of Science" are summarized. Another man would certainly have ended with a different number, but that is unimportant.

If there is to be any protest against the main argument of the book, it will probably not come from experimental scientists so much as from professional philosophers. For one thing, the latter are specifically tossed out the window as incompetent to interpret science, at least to a non-philosopher. Perhaps this opinion results from the prominence they have given to Karl Pearson's and Ernst Mach's views on the nature of science, views which Conant shows to be not merely inadequate but in fact downright misleading. Greater familiarity with Pearson's friend and contemporary, W. K. Clifford, or with Bertrand Russell or Henri Poincaré might have given experimentalists and laymen alike a clearer view. But scientists have often been leary of philosophers. One is reminded of the great controversy in Soviet Russia some years ago in which so many experimental scientists, including Timiriazev, the son of the famous plant physiologist, lined up as pedestrian "mechanists" against what they felt were the dizzy flights of Hegelian dialectical materialism. Conant wisely suggests that the extent to which such a course as he advocates should take cognizance of the existence of problems in metaphysics and epistemology would depend upon the outlook of the instructor and the interest and maturity of the student. In fact, he suggests that some collaboration with a philosopher might be desirable at this point after all. "Obviously the course in question would not be one on the metaphysical foundations of modern science." And obviously, we are getting close to very deep waters.

"No one," says Conant in conclusion, "can be a dogmatist about a course which has never yet been offered. I can only hope that a group of skillful teachers may in different colleges find some merit in my proposal."

GAIRDNER MOMENT

CRITICAL THINKING: *An Introduction to Logic and Scientific Method. Prentice-Hall Philosophy Series.* *By Max Black. Prentice-Hall, New York.* $3.75. xvi + 402 pp.; ill. 1946.

As the subtitle implies, this is an introductory textbook on logic and scientific method. It is divided into three parts, dealing respectively with deductive logic, language, and induction and scientific method. For a student of the sciences, the contents are well-balanced, since nearly one half of the book is devoted to the last topic.

The reviewer's experience with logic as an academic subject is extremely limited. But he remembers with considerable distaste his formal training in this subject and the text that he used. It was dry and artificial. Most of it was concerned with an examination of syllogistic arguments in their various ramifications, and any resemblance between the arguments presented and arguments in real life was largely accidental. Since then, the reviewer has seen others equally as bad, and it has always seemed unfortunate that so vital a subject should have been condemned to textbooks so dead.

This textbook, however, is a welcome change. It is interesting. The author has drawn heavily upon biographical material, newspaper stories, joke books, and even the Congressional Record, to illustrate his points. He makes use of stylized cartoons to dramatize the conditional argument. Each chapter ends with a series of exercises made up of the kinds of statements and arguments we hear and use constantly. The result is a book on logic that is alive and real. Logic becomes something not just to study but to use in everyday life. This does not mean that the text is light. The treatment appears to be fully as rigorous as is found in other introductory works, and the reader will have to take it in small doses. But without sacrificing content, the author has written an enjoyable book.

This text should be eminently satisfactory for introductory collegiate courses in logic. The reviewer wishes that he had had it when he studied the subject.

A. CHAPANIS

MORALE DE SAVANTS: *D'Hippocrate à Einstein. Collection Lebègue, 7th Series.*

By Jean Pelseneer. Office de Publicité, S. C., Bruxelles, Belgium. 25 fr. (paper). 129 pp. 1946.

The problem of whether a kind of ethics can be developed on a purely scientific basis was raised a few years ago in this country by Chauncey D. Leake in his *Ethicogenesis*, and a considerable discussion ensued. The present little source book on the ethics of scientists, published in the excellent Belgian Collections Lebègue and Nationale—why don't we have such handy, cheap, and competent series on all aspects of our culture?—shows that the same problem, very acute in the 18th and 19th centuries, is still discussed in Europe. The editor refers rather lengthily in his introduction to a book of Albert Bayet entitled *La Morale de la Science* (Paris, 1931). Adopting the Bayet-Leake point of view, Pelseneer has set out to document it.

That this source book draws primarily on French sources is rather natural. It has the shortcomings of all source books: too many of its selections are too short to be really significant. Still, Descartes, Réaumur, Lamarck, Benjamin Thompson, Arago, and Quetelet are represented by selections of sufficient length to be meaningful. Berthelot, H. Poincaré, Painlevé, Charles Nicolle, B. Russell, and Einstein are quoted in even greater length. A few selections like Franklin's letter to Lord Howe seem really unrelated to the subject matter.

Quite independently of whether ethics can actually be derived from science or not, scientists ought to be aware of ethical obligations and to know the admirable ethical precepts of the great protagonists of science. This book, bringing the latter into easy reach of the busy scientist, can therefore be most warmly recommended.

ERWIN H. ACKERKNECHT

ON THE RESOLUTION OF SCIENCE AND FAITH.

By Wendell Thomas. Island Press, New York. $3.50. xii + 300 pp. 1946.

Few books on the resolution of science and religious faith display the depth, vigor, or courage of this one. The author is possessed of a broad knowledge of each of the three fields—philosophy, religion, and science—which he here endeavors to unite in a synthesis.

The first part of the book, entitled, Exploratory, is a penetrating analysis of the history of monism through the centuries. Wendell Thomas begins with Anaximander's tò apeiron—"the boundless"—which the author interprets as space, not empty space, but space the "source, ground, and goal of all activity," the underlying reality out of which all things come, the boundless material soul of the universe. This is the author's basic idea and his ultimate identification of God. Through the ideas of the later Greek philosophers he traces the emergence of dualism into Western thought and its struggle with monism. Beginning with the contributions of the religion of Jesus and the Hindu Vedanta to this struggle, he follows it through Thomas Aquinas, Spinoza, and George Fox to Sir Isaac Newton, in whose thinking the combination of science and faith attained a new, yet still incomplete, solution. The contributions of Kant, Hegel, Marx and Engels, John Dewey and the modern realists, and the non-dualistic, non-deterministic evolutionists such as Lloyd Morgan are added to the analysis.

The author thus comes to Part Two, Analytical, in which he considers the scientific views of the nature of space, time, and the cosmos. Part Three, boldly titled Constructive, discusses the nature of a scientific faith. A table (p. 180) that considers God as material, efficient, and final cause in the concepts of physics, psychology, and value theory respectively, sums up the author's monistic theism, and is well worth study. Chapters with challenging titles follow: What Psychology and Physics Can Share; Theology as Fundamental Science; The Needlessness of Doctrinal Problems.

Next comes a consideration of biological questions in relation to the author's conceptions: Can Life Come from Matter?; Evolutionary Surprises; Is Man Unique in the Cosmos?; Mankind Is Still Emerging. One need only emphasize that Wendell Thomas sees the weaknesses in both vitalistic and mechanistic views of nature, and that his grasp of evolutionary fact and theory outclasses that of Lecomte du Nöuy (*Human Destiny*). One may forgive a non-biologist for too implicit a trust in such false guides as George Crile. On the whole, the author picks and interprets his sources of biological information very well.

The book ends with a consideration of The Threefold Task of Social Science: "to outline through history and its ideal projection the values at which man, both 'individually' and collectively, should aim; to discover through psychological study how man might be induced to attain these valued objectives; and to analyze through sociology the human material, or social structure with which we must deal." The fulfilment of these tasks is seen in the view that "creative life, or progress, is not a one-way affair; it is cosmic reciprocity in which man, who is master, is the servant of all. The function of man in the earthly kingdom of God is mediate, focal, coordinating, like that of the nervous system."

Well-written, this book is nevertheless not easy reading, for its thought is closely knit. The scientific portions will likely seem as difficult to a philosopher as the philosophical portions appear to a scientist. The book may find few readers, but it demands respect. It is well documented and has a rich bibliography. It has a timeless quality, and its audience should grow through the years.

BENTLEY GLASS

GENERAL BIOLOGY. *Third Edition.*

By James Watt Mavor. The Macmillan Company, New York. $5.50. xiv + 986 pp.; text ill. 1947.

The revision of this widely used textbook (cf. Q. R. B. 16: 482. 1941) brings its total number of pages to almost a round thousand. The changes made appear to have been largely matters of rearrangement. For example, Part V has now been subdivided into two parts, one on Development and Heredity, the other on The Organic World and Its Evolution. To the latter there has been added a 58-page chapter on Animals and Plants in Relation to their Environment, which excellently fills in the ecological hiatus of earlier editions. The chapter on The Mechanism of Organic Evolution has been much expanded, and now includes a consideration of population genetics altogether novel in an elementary college textbook.

The new edition is not printed on paper of as good a quality as was formerly used, and the quality of the illustrations has as a consequence suffered materially.

BENTLEY GLASS

LABORATORY EXERCISES IN GENERAL BIOLOGY. *Third Edition.*

By James Watt Mavor. The Macmillan Company, New York. $3.00 (paper). xiv + 333 pp. + 3 plates; text ill. 1947.

The revision of this widely used laboratory manual introduces little, if any, fundamental change. There is an added exercise on a Simple Plant (*Spirogyra*) and a Simple Animal (*Hydra*) at the beginning of the course; a more detailed study of the cell, particularly of cell physiology, and of bacteria; an added study of the life cycle of *Selaginella;* a unit on the Parasites of the Frog; and a short exercise on the sagittal section of the dogfish. There has been some rearrangement of the exercises, and sample schedules for year courses with a single and with two laboratory periods per week are provided.

LIFE SCIENCE: *A Survey of the Various Fields of Biology. Third Edition.*

By M. W. de Laubenfels. Prentice-Hall, New York. $4.75. iv + 340 pp.; ill. 1946.

This unusual book now appears in its third edition. Although the reviewer has not had the benefit of examining previous editions, it is to be assumed from the Preface that the third is similar to the second revised edition.

The adjective "unusual" was purposely selected, as it best describes the variance of the present book with the majority of orthodox textbooks in the field. No other book attempts to cover the wide range of scientific knowledge that this does. Selected at random, chapter headings include biophysics, hygiene, dietetics, oceanography, eugenics, and philosophy. This varied assortment is apportioned to 26 chapters (A to Z, instead of 1 to 26) which follow one another in a rather logical sequence. The chapters are grouped into eight parts, of three or four chapters each, containing closely related subject matter.

The first impression obtained from such a table of contents is that the text will be rather vague and superficial. It is true that no topic is probed deeply, but the writer maintains that a beginning student should first have a survey of life sciences and that specialization follows. The humorous, and at times dramatic, method of presentation, interlarded here and there with useful practical examples by way of analogy, make this a highly readable volume. A few statements were noted that are at variance with the facts, but as a whole the presentation is as accurate as an elementary textbook can be. By including such a varied array of sciences the writer should indeed accomplish one purpose: to impress the student with the fact that no discipline is independent of any other. Anyone who desires to change the standard methods of presenting beginning biology should become familiar with this publication. It affords many interesting ideas that break away from the clichés found in so many biology books. Even the numerous drawings and photographs are highly original.

HENRI C. SEIBERT

LIVING THINGS: *How to Know Them. An illustrated key to the phyla, classes and more important orders of Plants and Animals with suggestions for studying them. Pictured-Key Nature Series. Revised Edition.*

By H. E. Jaques. Wm. C. Brown Company, Dubuque, Iowa. $2.50 (cloth); $1.50 (spiral). iv + 172 pp.; ill. 1946.

This little book is a picture key to the phyla, classes, and more important orders of plants and animals. Although its greatest popularity will be for beginners in nature study, who will probably not appreciate the foreign words by which animals and plants are recognized, it is nevertheless unfortunate that so many scientific names have been misspelled. A cursory examination revealed "Cestus" and "Cestis" for *Cestum*; "Ancyclostoma" for *Ancylostoma*; "Libelula" for *Libellula*; "Phylophaga" for *Phyllophaga*; "Polydon" for *Polyodon*; "catesbiana" for *catesbeiana*; "Eranaceus" for *Erinaceus*; "Ceryte" for *Ceryle*; "flaxiventris" for *flaviventris*; "Amydia" for *Amyda*; "Pycnoganida" for *Pycnogonida*, etc.

Elementary biology teachers who find themselves required to identify all manner of organisms may find this an useful aid. It is not restricted in geographic scope, hence many exotic species are included that are likely to be seen at the zoo. There are 117 suggestions for projects to stimulate interest in nature study.

HENRI C. SEIBERT

BASIC PRINCIPLES OF GENERAL BIOLOGY. (*A laboratory with synoptic text material.*)

By Clair L. Worley. Wm. C. Brown Company, Dubuque, Iowa. $3.00 (unbound; perforated for notebook). vi + 269 pp.; ill. 1946.

The chief characteristic of this laboratory guide, which has a modicum of introductory text accompanying each exercise, is that it really is confined to general principles, that is, to certain general principles. The consideration of plants is limited to the thallophytes and that of animals goes no higher in the scale than the coelenterates. Such a manual will therefore be suitable only where the introductory course in biology can be followed by courses in both general botany and general zoology. The manual is neat in appearance, and the drawings are attractive. Mitosis, however, is all tangled up with spiremes; and meiosis is presented from a diagrammatic, "reduction division followed by equation division" point of view. The cell and cellular physiology are emphasized, but genetics, embryology, and evolution are apparently not considered by Worley to have any contribution to make to the "basic principles of general biology." This narrow basis for the selection of subject matter will not recommend the manual to many teachers of biology.

BENTLEY GLASS

EVERYDAY PROBLEMS IN SCIENCE. *Basic Studies in Science. Second Edition.*

By Wilbur L. Beauchamp, John C. Mayfield and Joe Young West. Scott, Foresman and Company, Chicago, Atlanta, Dallas, New York. $2.40. xvi + 752 pp.; ill. 1946.

This revised general science textbook for high school students has 20 units, of which only 5 are biological in subject matter. These deal with: the common characteristics of living things; food and nutrition; human anatomy, physiology, and hygiene (but with nothing on sex or reproduction); germs and disease; and conservation. The illustrations are interesting, but the halftones are not very clear. The diagrams and drawings are good. The style of the text is interesting and simple. The introductory section on the methods of science is very good, without departing from the level of the remainder of the book. Experiments and problems to solve, and lists of supplementary reading are suggested, section by section. A science glossary and a full index conclude the book.

This is a good example of the present type of general science textbook used in the United States. Its nature raises several questions: if the student is going on to take biology in the following year, as so many do, wouldn't it be better to devote all 20 units to the physical sciences? If this is all the science study the student will have in high school, what an appallingly meagre introduction to biology! Most science books for the younger grades cover the same topics in almost an identical way.

BENTLEY GLASS

BIOLOGY: HISTORY AND BIOGRAPHY

THE MEDICAL WRITINGS OF ANONYMUS LONDINENSIS. *By W. H. S. Jones. Cambridge University Press, Cambridge.* $2.75. viii + 168 pp. 1947.

This is the expert transcription and translation of a Greek papyrus, probably of the second century A.D. The contents are a discussion of the causes of disease according to various authorities of antiquity, and of physiological theories after Herophilus of Alexandria. The fragmentary and careless character of the book suggests that we are dealing with a student's notebook. Parts of it might be based on the writings of Menon, a pupil of Aristotle. The papyrus offers interesting additional information on the history of Greek medicine to the specialist, but is unlikely to be attractive to the average scientist interested in the history of medicine.

ERWIN H. ACKERKNECHT

ANDRÉ VÉSALE. *Collection Nationale, 1re Série, No. 7. Second Édition.*

By Georges Leboucq. Office de Publicité, J. Lebègue & Cie., Bruxelles. 25 fr. (paper). 101 pp.+ 1 plate. 1944.

This brochure, written in French by a Belgian anatomist, was apparently timed for the four-hundredth anniversary of the publication of *De Humani Corporis Fabrica Libri Septem.* It is a largely second-hand account of the life and influence of the founder of human anatomy. There are six chapters, dealing, respectively, with (1) the fore-runners of Vesalius, (2) Vesalius as an anatomist, (3) as a physician, and (4) as a man, (5) anatomy from Vesalius to Harvey, and (6) the physiology of Vesalius. The last chapter, written by the Belgian physiologist De Waele, consists chiefly of a translation of book VII, chapter XIX, of the *Fabrica*:—Some Considerations on the Dissection of Living Beings.

WILLIAM L. STRAUS, JR.

JEROME CARDAN. *Supplements to the Bulletin of the History of Medicine, Number 7.*

By James Eckman. The Johns Hopkins Press, Baltimore. $2.00; for subscribers to the *Bulletin of the History of Medicine*, $1.75 (paper). xiv + 120 pp. 1946.

This short monograph, which takes the form of a re-evaluation of the life and works of Jerome Cardan, is a

well-written and painstaking study of the enigmatic Italian sixteenth century mathematician and scientist.

Its primary virtues are its accuracy, thoroughness, and objectivity. Cardan is familiar as the inventor of the universal joint which still bears his name, notorious as the astrologer who cast the horoscope of Christ, infamous as the publisher in his own works of Tartaglia's method for the solution of cubic equations. Sir Thomas Browne has said of him that he was "a great enquirer of truth, but too greedy a receiver of it." Eckman has assessed the wealth of available fact and fiction concerning him, has emphasized his less recognized contributions to medicine, and has succeeded in presenting fairly and weighing judiciously the evidence on controversial issues according to the best precepts of cautious and exhaustive scholarship.

Its very strength, in this respect, is responsible for the study's greatest weakness. This is an elusive fault to define or describe. It is perhaps a kind of bookishness —something different than straight pedantry. It may best be illustrated by a few examples. Its defensive attitude towards the University of Padua, for instance, of which Cardan was Rector, implies that posterity has failed to recognize the contributions of that institution to the Renaissance. Perhaps no one has ever written a monograph for the sole and express purpose of extolling the position in history of that university, but there are few if any historians of Renaissance medical science who have not fully appreciated its preeminence. The author's explicit statement, and its justification by references to secondary sources (excluding Haskins, by the way), that "it is now recognized that there had been other . . . periods of renascence before the Renaissance" is gratuitous today, and a little naive. Again, Eckman's resentment of the fact that in 1945, "the quatercentenary of the publication of Cardan's *Ars Magna* . . . Cardan was in no wise accorded the tributes paid to Vesalius and Copernicus in 1943," is wholly academic. Misjudged though he may have been by posterity, and even Eckman can convince us of no more than this, Cardan's contributions in no way exerted the kind or magnitude of influence on the fabric of contemporary ideas nor on the evolution of subsequent ones of either the *De Fabrica* or the *De Revolutionibus*.

The author might well have done better to devote some energy to pointing out that the kind of contemporary sixteenth century rumor which could lead to the myth that Cardan bit off the ear of his son, smacking to us of scandal-mongering, was abundant in sixteenth century biography; and that de Thou, for instance, has been shown by posterity to have been as sensationalist in relating anecdotes about other sixteenth century scientists. There are subtler ways of relating a man to his contemporaries than by the bare enumeration of the names of the men who were alive in his day.

What I mean to imply is that while Eckman's facts about the era in which Cardan lived are accurate, they do not give the "feel" of the times to the reader. So too for the man himself. It may sound paradoxical, but for one reader at least it is apt to comment that Eckman *suggests* that Cardan must be a more interesting figure than he *shows* him to be; he never comes quite alive. It is as though Eckman had a greater interest in the writings about Cardan and his times than in the man himself and the Renaissance itself. What lacks is the author's sense of identification of himself with the man who is his subject and with the thought characteristic of his age—an identification which is the vitalizing ingredient of the most vigorous of our retrospective studies. That accuracy and carefulness and dispassionateness need not be sacrificed to such indulgence of the imagination is well proved by Sherrington's analysis of *The Endeavour of Jean Fernel*.

These remarks are in no wise meant to detract from the considerable contribution of the author in applying the most critical methods of historical research to the production of a work of this sort. Students of the history of medicine in the past have too often failed to apply in their historical ventures the same kind of critical thinking that they devote to what they consider their more strictly scientific endeavours. This monograph happily indicates that this is a phase which we are leaving behind us. We are urgently in need of much more of the same sort of evidence. Eckman's study of *Jerome Cardan* is on the whole a monograph well worthy of inclusion in the distinguished series of supplements sponsored by the *Bulletin of the History of Medicine*.

Commendable is the enlightened practice of the editors in allowing quotations to be presented in the language in which they were written (only why, then, the anglicisation of Jerome?). The bibliography would, however, be more useful if the entries were arranged in some more meaningful order than the sequence in which the works cited happened first to be mentioned in the text.

JANE OPPENHEIMER

J.-B. VAN HELMONT. *Collection Nationale, 7th Series. By Henri De Waele. Office de Publicité, S. C., Bruxelles.* 25 fr. (paper). 79 pp. + 1 plate. 1947. This is a competent, short review of the life and work of the great 17th century Belgian medical chemist. Particular attention is given to the Inquisition trial of van Helmont, pending for sixteen years. Good use is made of the numerous Belgian source studies of the last hundred years. Van Helmont's Flemish book *Dageraed* (not the customary *Ortus*) is mostly used for documentation of his scientific views. Although the author has little use for van Helmont's mysticism, he is sufficiently impressed by his positive accomplishments to give his due to the pious Belgian nobleman who was one of the great scientific reformers and pioneers of the 17th century.

ERWIN H. ACKERKNECHT

400 YEARS OF A DOCTOR'S LIFE.

Collected and arranged by George Rosen and Beate Caspari-Rosen. Henry Schuman, New York. $5.00. xviii + 429 pp. 1947.

From selections out of about one hundred medical autobiographies, mostly 19th century products, but incorporating also older worthies like Paré, Paracelsus, Felix Platter, or Cardanus, the authors have constructed a kind of mosaic portrait of the Doctor, his youth, student days, daily practice, and scientific endeavors. The doctor is also shown as a marriage candidate, a patient, in war and in politics. Those who like anthologies will find here a most sensitive and stimulating selection, moving and enlightening at the same time. The authors master their subject matter. There is a fine balance between the "classics" of medical autobiography and less known sources, between European and American material, between older and more recent pieces, between men and women. The external appearance of the book, the translations, and the short introductory notes are excellent.

ERWIN H. ACKERKNECHT

THE WORLD GROWS ROUND MY DOOR: *The Story of the Kampong, a Home on the Edge of the Tropics.*

By David Fairchild. Charles Scribner's Sons, New York and London. $5.00. xiv + 347 pp.; ill. 1947.

An appropriate subtitle for this book might be "The Fruits of My Labor," for in a literal, as well as in a figurative sense, this story of the Kampong, Fairchild's home at the edge of the Florida tropics, is one largely concerned with the joys and surprises, the disappointments and even tragedies that arise out of the introduction and cultivation of the many tropical and exotic fruits which he, as plant explorer extraordinary, had uncovered in his travels around the world. It is an intimate book, revealing a warm and varied personality who has found life to be as flavorful and fullbodied as one of the mango fruits he never ceases to delight in describing. It is a readable book, full of reminiscences and personalities, both plant and man. And it is a proud book, as well as it might be, for David Fairchild can truly be said to have richly harvested the fruits of his labors.

One need not be a botanist to enjoy the many hours of reading pleasure which this book affords, for Fairchild has the rare faculty of making his readers share his experiences. The numerous photographs add to the book, giving form to the fruits with which he has worked, and the men—Swingle, Merrill, Popenoe, and Tom Barbour, to name a few—with whom he has been associated. A single minor criticism might be made, and that concerns the undertone of querulous impatience Fairchild shows for those who cannot appreciate and share his points of view. Although understandable, it does not permit the enjoyment of the book to its fullest.

C. P. SWANSON

THE ROYAL BOTANICAL EXPEDITION TO NEW SPAIN *1788–1820 as described in documents in the Archivo General de la Nación [Mexico]. Chronica Botanica, Volume 11, Number 1.*

Translated and collated by Harold William Rickett. The Chronica Botanica Company, Waltham, Massachusetts; Stechert-Hafner, New York. $2.50 (paper). Pp. 1–86 + 9 plates; text ill. 1947.

From the national archives of Mexico, Rickett has extracted and described chronologically the work of the botanical expedition sent in 1787 by Charles III of Spain to survey his domain of New Spain (Mexico) for natural products, and to establish a botanical garden. The result is a volume which should be of much interest to the student of Latin America as well as to the student of botanical history, for, in addition to information of a purely botanical nature, it contains much concerning the political and social conditions of that period of Mexico's struggle as a Spanish colony.

C. P. SWANSON

V. O. KOVALEVSKY. *Series of Popular Science: Biographies.*

By L. Sh. Davitashvili. The Academy of Sciences of the USSR, Moscow and Leningrad. R. 20.– 420 pp. + 8 plates. 1946.

This is the second biographic book on Vladimir Onufrievich Kovalevsky, the first one having been written twenty years ago by the late academician Borissiak. The author of the new book is one of the ablest among the post-revolutionary Soviet paleontologists. Prudently announcing his intention to write truth and nothing but the truth about the man who is becoming recognized as the greatest among Russian paleontologists, perhaps even among philosophical paleontologists of the world—Davitashvili proceeds to unfold systematically Kovalevsky's life's drama—and what a drama it was, leading to a tragic end of a noble, though strangely unadaptable, "out of this world" soul! With the skill of a psychologist the author analyses the development of the great man's personality, shows how his scientific ideas were born, how he created a new analytical approach to solve the problems of evolution of fossil organisms, an entirely new and powerful philosophical method, which even now has not been completely understood and mastered by his successors. The author sketches, as he goes, also the contemporary epic struggle, in which Kovalevsky took a prominent part: that clash between old and new ideas as to the origin of organisms, the "Sturm und Drang" period of revolu-

tionary Darwinism. Kovalevsky's correspondence and personal pilgrimages to the great man of Down, his decision to devote his life to his cause, and his consistence in the execution of the great self-imposed task, are narrated by Davitashvili in a manner both compelling and literary, holding the reader's attention even through the pages of scientifically most difficult explanations of Kovalevsky's contributions to our knowledge of the intricate, step-by-step evolution of horses and other selected herbivores.

The book will easily find a place among classic biographies of scientists, as an example of how to write an impartial, documentary account of a man's life and relationships with other human beings, yet making it so interesting, and at times even breath-taking reading. Kovalevsky stands before us in flesh and blood, with all his virtues and faults. His devotion to his wife and selected friends does not prevent him from hurting them occasionally and inadvertently. His puritanism, honesty, and kindness do not shield him from vicious slander. His capable and hard work in translating and publishing classics in the natural sciences brings him only a modest income, he becomes involved in financial follies, and ends his life when faced with bankruptcy and inability to provide for his wife.

Kovalevsky's zeal and genius in scientific achievments slowly gained for him recognition and fame among the foremost scientists of his time, but his temperamental impatience with mediocre colleagues, who did not understand him, resulted in making him bitter and vindictive enemies. The general pattern of the drama is the same for many men of talent and distinction, repeated through the history of mankind.

A specialist in the evolution of vertebrates will find some professionally interesting and useful information on Kovalevsky's accomplishments and his method of work, that method hailed by Osborn as classical in paleontology. Davitashvili has done a good job in extracting from Kovalevsky's monographs the most instructive examples of the paleontological material on which his method was based and tested, and has republished appropriately selected original illustrations.

Appended are (1) a bibliography of Kovalevsky's original contributions; (2) a list of the scientific books translated, edited, and published by him; and (3) the literature cited in the present biography. The book is attractively published, on good durable paper, with a few portraits of Kovalevsky and facsimiles of his letters and pen sketches; but reproduction of the photographs is poor, and so is the material of the cloth cover, although its workmanship is neat and the cover is artistically attractive.

M. K. ELIAS

ECOLOGY AND NATURAL HISTORY

THE LAND AND WILDLIFE.
By Edward H. Graham. Oxford University Press, New York. $3.00. xiv + 232 pp. + 32 plates. 1947.

The main thesis developed in this book is that the fate of wildlife ultimately rests on the fate of the land. The most beneficial utilization of land to man involves careful husbandry and thoughtful exploitation of its potentialities. When this fact is appreciated and acted upon, the wildlife will take care of itself. Wildlife will not survive in overworked, overgrazed, eroded, polluted, burnt, and otherwise damaged areas. Those species that occasionally invade areas of such type are in general undesirable ones, as ground squirrels and prairie dogs in overtaxed grasslands. No matter how many refuges are created, pen-reared animals released, or laws and regulations passed, the productivity of wildlife will not be materially increased thereby. Success will be achieved only by converting all available farms into potential wildlife refuges by promoting an interest in the proper methods of soil conservation. This includes the creation of field borders, hedges, and windbreaks around crop lands; roadside and streamside plantings; plantings in gullies and other eroded areas; proper care of woodlots, forests, marshes, and ponds. If these procedures are adopted, not only will the land benefit, and of course the owner too, but the wildlife will increase and maintain itself because of these very same practices.

The arguments presented here follow the newer concepts now being adopted in isolated instances in the field of wildlife management. The tendency is toward closer cooperation between the individual land owner and the various administrative agencies which are concerned with land management. Marked success has followed most of these ventures. However, there are still a number of drawbacks. For some wildlife, such as migratory game, the problem is not easily solved on the basis of land use alone. But for a long term, overall objective, the data and conclusions propounded in this book are hardly assailable. It is encouraging to learn that the Chief of the Biological Division of the U.S. Soil Conservation Service has brought forth a logical, unbiased, and practical scheme for conserving our national fauna.

Methods of managing field borders, woodlots, hedges, strip-mined areas, erosions, outcrops, range, pasture, streams, ponds, etc., for the betterment of wildlife are discussed. There is a bibliography, an index, and numerous plates that vividly show the improvements resulting from wise land use. Figures and tables supply much factual information.

HENRI C. SEIBERT

ANYWHERE IN THE WORLD: *The Story of Plant and Animal Adaptation.*
By Irma E. Webber. William R. Scott, New York. $1.50. 64 pp.; ill. 1947.

A children's book on the geographic distribution and adaptations of plants and animals, showing how various

environmental problems are dealt with. The book is profusely illustrated with colored drawings, has an interesting narration, and should prove attractive to children.

EVOLUTION

CAMBRIAN HISTORY OF THE GRAND CANYON. *Part I. Stratigraphy and Ecology of the Grand Canyon Cambrian. Part II. Cambrian Fossils of the Grand Canyon. Carnegie Institution of Washington Publication 563.*

By Edwin D. McKee (I) and Charles E. Resser (II). Carnegie Institution of Washington, Washington, D. C. $3.00 (cloth); $2.50 (paper). viii + 232 pp. + 27 plates. 1945.

The Grand Canyon area has always had a special scientific fascination for students of all branches of the geological and biological sciences. To the geologist the opportunities for tracing the rock units for long distances along the walls of the canyon has afforded unrivalled demonstrations of basic principles of stratigraphic geology. The first parties to explore the entire canyon from end to end by boat were led by a geologist, Major John Wesley Powell, in 1869 and 1871. (Powell later became the founder and first director of the United States Geological Survey.) A multitude of other geologists have followed Powell in studying the rock sequence here, but no one has had the opportunities that were afforded E. D. McKee during the several years that he served as Chief Naturalist at the Grand Canyon National Park. The present volume is but the latest of the series of detailed stratigraphic studies that have resulted. It maintains the high standards that were built up by its predecessors.

McKee shows that the Cambrian deposits of the Grand Canyon include numerous widespread fossil beds, thin but persistent conglomerate zones, and other horizons of distinctive lithology. These have been traced in the practically continuous exposures of the canyon walls and their relationships to each other have been examined in detail. Study was made of the relation of time planes to lithogenetic units, and also of the association and sequence of facies within definite time zones.

With this information it has been possible to demonstrate that the lower Cambrian sea advanced across the area, from west to east, as a result of discontinuous subsidence of the basin that existed in the area. When the sinking of the basin was relatively rapid, the sea transgressed it rapidly; when the rate of subsidence was slow, or the basin was static, the accumulation of deposits within it forced the sea to withdraw. During each period of marine transgression, the same general sequence of deposits was developed from the open sea to the shore; during periods of regression a different sequence was deposited. The result is a clear picture of the manner in which lithologic facies cut across time lines. During any one period of transgression, for example, the shoreline facies to the west would be older than the strata of the same facies in its easternmost development formed at the time of maximum transgression. Thus it is possible for McKee to prove that the Tapetts sandstone, the basal Cambrian formation of the Grand Canyon sequence, is of lower Cambrian age near the western end of the canyon, and lower Middle Cambrian age near the mouth of the Little Colorado River.

The faunal descriptions by Resser form the first relatively complete picture of the Cambrian fauna of that area, and are based on a large number of collections made over the years by members of the U S. Geological Survey, the U.S. National Museum, and members of the Grand Canyon National Park naturalists staff. Perhaps the most noteworthy element of the fauna is a species of cystoid, described by Edwin Kirk, from two relatively complete crowns, with arms, found near the base of the Middle Cambrian sequence in the Bright Angel shale. Trilobites and lingulellid brachiopods dominate the fauna, although a number of species of ostracods also occur.

H. E. VOKES

REVISION OF THE UPPER CAMBRIAN FAUNAS OF NEW JERSEY. *Geological Society of America Memoir 12.*

By B. F. Howell. Geological Society of America, New York. 85 cents (paper). 46 pp.; 8 plates. 1945.

The upper Cambrian deposits of New Jersey consist of dolomitic limestones that are often sandy or shaly, and locally grade laterally into lenticular shales and sandstones. Mud cracks and ripple marks are common and indicate that most, if not all, of the beds are of shallow water deposition. These strata have been referred to the Kittatinny formation.

In view of the type of lithology and of the apparent depositional facies represented, it is not surprising that fossils are rare and, when found, poorly preserved. Howell has gathered together all the previously described forms (15 species) and has added the material that he has collected over many years of investigations in the area. The result is a fauna of 50 forms, of which 34 are trilobites, 11 brachiopods, 2 hyolithids (believed by the author to be worms rather than pteropods), 1 conchostracon, 1 graptolite, and 1 calcareous alga. Three new genera of trilobites are described. All of the fossils come from four general localities.

Two upper Cambrian horizons are recognized, one is early upper Cambrian (Dresbachian), the other late upper Cambrian (Trempealeauian) in age. Howell notes that no evidence has been found for the existence of medial upper Cambrian (Franconian) strata in New Jersey, and is inclined to believe that there is a sedimentary break within the Kittatinny. No stratigraphic evidence of such a hiatus has, however, been discovered.

The full-tone plates reflect the poor preservation and

fragmentary nature of the material that the author has had to deal with.

H. E. VOKES

BRACHIOPODA OF THE INDEPENDENCE SHALE OF IOWA. *Memoir 14.*

By Merrill A. Stainbrook. The Geological Society of America, New York. $1.00. vi + 74 pp.; 6 plates. 1945.

Forty species of the Brachiopoda are described from the upper Devonian Independence shale of Iowa; 27 are new species. They are placed in 35 genera, 7 of which are diagnosed here as new. These are *Douvillinaria* and *Pseudodouvillina* (Stropheodontidae, Douvillininae) *Gamphalosia* (Stropheodontidae, Leptostrophiinae) *Calvinaria* (Camarotoechiidae, Leiorhynchinae), *Hystricina* (Atrypidae, Atripinae), *Acutatheca* (Spiriferidae Spiriferinae), *Thomasaria* (Spiriferidae, Ambocoeliinae).

The fauna is considered to be the American equivalent to the lower Upper Devonian "Cuboides fauna" of Europe. Its American correlatives are discussed in detail. The descriptions are full and the illustrations of excellent quality.

H. E. VOKES

ANCIENT PLANTS *and the World They Lived in.*

By Henry N. Andrews, Jr., with drawings by Anna Schutte. Comstock Publishing Company, Ithaca, New York. $4.50. xii + 279 pp.; ill. 1947.

It has been several years since Knowlton's *Plants of the Past* first appeared, and it has long been out of print, leaving us with no popularly written, yet authoritative account of the fossil plant record. The present volume fills this gap in very acceptable fashion, so far as the more ancient and more primitive plants are concerned. The absence of anything beyond a brief mention of the great groups of angiosperms is puzzling and leaves the work notably incomplete.

The book consists, essentially, of a number of essays, each relatively complete in itself, and each not necessarily having any particular relationship to that which precedes or follows it. At times the order of presentation seems wholly a haphazard one. According to the author, he has "tried to introduce first the plant groups with which the lay reader is already familiar, and to tell something of our knowledge and our methods of seeking out their geological history." Even this seems inadequate to explain the fact that Chapter 3, Lingering Remnants of the Coal Age, precedes Chapter 5, Coal, Fuel from Yesterday's Forests, and is separated from it by a discussion of the Invasion of the Land, concerned with the Silurian and Devonian types of most primitive land plants. Similarly the sequence of the last five chapters (Changing Climates of the Pacific Coast; The Algae, Fungi, and Mosses; The Fossil Hunters; Past Epochs of the Arctic; Genealogies in the Plant Kingdom) seems explicable on no basis save that of whim.

Despite this seeming confusion, and even despite the absence of any approach to an adequate consideration of the angiosperms, this is a good and a needed work that will well merit reading by anyone who desires to have some knowledge of the history of the fossil plant record.

H. E. VOKES

MANUEL DE PALÉONTOLOGIE VÉGÉTALE.

By Léon Moret. Masson et Cie., Paris. 250 fr. (paper). viii + 216 pp.; ill. 1943.

This work, as indicated by the title, is a manual whose major portion is devoted to a consideration of the important plant groups, arranged in a strictly biological order. The general nature of the work is perhaps best indicated by a consideration of the general table of contents. Following a short introductory chapter on the importance of the science of Paleobotany, the methods of fossilization of plant remains, the origin of the "monde végétal," and the main stages in the evolution of the plants, the work is divided into five parts, as follows:

Part 1. Thallophytes: the Bacteria, Flagellates, Algae, Fungi and Lichens, and Charophytes.

Part 2. Bryophytes.

Part 3. Pteridophytes: the Psilophytales, Lycopodiales, Equisetales, Filicales, and the Cladoxylales.

Part 4. Spermatophytes: the Gymnosperms (including the Pteridosperms, Cordaitales, Cycadales, Bennettitales, Ginkgoales, Coniferales, Gnetales and Caytoniales), and the Angiosperms.

Part 5. General Conclusions: this includes a most interesting series of chapters discussing such topics as the "transformations" of the plant world, the role of plants in the formation of rocks, and the carbonaceous rocks and the formation of coal.

The work is copiously illustrated, most of the figures including a number of line drawings of vegetative or reproductive characters important in the identification of various plant types. They are an important adjunct to a valuable and useful manual of the fossil plants.

H. E. VOKES

PERMIAN FUSULINIDS OF CALIFORNIA. *Geological Society of America Memoir 17.*

By M. L. Thompson, Harry E. Wheeler, and John C. Hazzard. The Geological Society of America, New York. $1.25. viii + 77 pp. + 18 plates. 1946.

This work is divided into three parts. Part I includes a most valuable summary of the more important Per-

mian fusulinid faunas of North and Central America. Four fusulinid zones are recognized, and the ranges of all the genera known to be present in the faunas are indicated. In addition, a summary of the classification and generic characters of all the genera found in the California faunas is presented here.

Part II, by M. L. Thompson and Harry E. Wheeler, describes the faunas from the McCloud limestone and Nosoni formation of the Redding area of northern California. Thirteen species are recognized, including two that are referred to the genus *Neofusulinella*, a form that otherwise is known only from the Orient.

Part III, by M. L. Thompson and John C. Hazzard, describes faunas obtained from the Bird Spring limestone in the Providence Mountains of San Bernardino County, southern California. Fourteen forms are recognized, only one of which is also found in the McCloud fauna from northern California.

H. E. VOKES

CONTRIBUTIONS TO THE PALEONTOLOGY OF THE LEBANON MOUNTAINS, REPUBLIC OF LEBANON. *Part 3. The Pelecypod Fauna of the "Olive Locality" (Aptian) at Abeih. Bulletin of the American Museum of Natural History, Volume 87, Article 3.*

By Harold E. Vokes. American Museum of Natural History, New York. $1.25 (paper). Pp. 139–216; text ill. + 10 plates. 1946.

In the course of the decade since Vokes started his research on post-Paleozoic marine pelecypods, he has reached maturity of judgment, which places him among the leading contemporary specialists in this group of fossils. His present contribution to the knowledge of Cretaceous bivalves is not only useful for the geology of the Near East, but is also philosophically important for the disentanglement of the complex phyletic relationships and evolution of these mollusks.

The selection for research of Lebanon fossil bivalves is fully justified by the unusually fine preservation of their details, particularly those pertaining to the hinge, on which the current recognition of genera of these mollusks is universally based. Thanks to the superior preservation of the material, Vokes has been able to erect many new fossil genera: out of forty genera described, eight are new (including one by Stephenson, and cited with a permission from his MS); it may be added that among the identified and previously established 32 genera three were recently (1944, 1945) erected on the same material by Vokes. Of the 58 species described 24, or nearly two-fifths, are new.

The description of genera and species shows a careful comparison with the previously described fossil and living pelecypods of the world, some types having been examined in European museums. A brief chapter on ecology is comprehensive, and the conclusion that the fauna does not belong to the zone of tides, but is next deeper to it, yet not deeper than 50 fathoms, seems well substantiated.

The illustrations (collotype reproduced photographs), though mostly satisfactory, in many instances look flat, with the details of sculpture barely discernible. Standardized illumination from the left upper corner, with greater contrast in negatives and prints, and a regular arrangement of sets of front, back, top, and side views for each species could be recommended.

The large per cent of new genera (11 out of 40) established on the evidence of good preservation of generic characters is an important evidence of the actual existence of much greater numbers of fossil pelecypod genera than are registered in the present manuals of paleontology, and which have been recently used statistically to prove a supposed slower evolution of mollusks as compared with Tertiary vertebrates (G. G. Simpson, *Tempo and Mode in Evolution*, 1944). The existence of a substantially larger number of late Paleozoic genera of pelecypods than are entered in the manuals, and the evidence of about as fast an evolution of the genera of Triassic ammonites (see J. P. Smith, 1927, 1932, and not entered in H. H. Swinnerton's *Outline of Paleontology*, which Simpson used), have been already mentioned in the reviewer's paper read at the first annual meeting of the Society for the Study of Evolution (December 1947). The data by Vokes provide additional evidence that the current statistics of the fossil mollusk genera should be substantially revised.

M. K. ELIAS

EOCENE FAUNAS FROM THE DEPARTMENT OF BOLIVAR, COLOMBIA. *The Geological Society of America Memoir 16.*

By Bruce L. Clark and J. Wyatt Durham. The Geological Society of America, New York. $1.75. vi + 126 pp.; 27 plates; 1 map. 1946.

This work consists of two parts: a description of the molluscan faunas, by Clark, and of the coral faunas, by Durham. The material studied was largely furnished by the Standard Oil Company of California, having been collected by their field geologists during the investigations of the El Carmen district of the Department of Bolivar. While the company furnished the authors with a copy of the geologic map for their use during the course of the study, they did not release it for publication, nor did they permit the use of the reports of their geologists on the district. As a result, although it was possible for the authors to place the collections in their correct stratigraphic position, the stratigraphic data that would have added much to the value of this report are lacking.

On the basis of the Mollusca, Clark divides the fauna into three zones (A, B, and C). The fauna of Zone A contains species closely related to some from the middle Eocene of Peru, and in addition, two forms that were

originally described from the middle Eocene of California. Zone B has several species identical with, and some that are closely related to the fauna of the Talara formation of Peru, described by Olsson. Olsson correlated the Talara with the lower Jackson, of the southeastern United States and with the Bartonian of Europe; Clark concurs in assigning an early upper Eocene age to the assemblage. The fauna of Zone C is the largest and best preserved. It contains species described by Olsson from the Saman formation and the Chira shales of Peru. Olsson considered that these were of uppermost Eocene and lower Oligocene age, respectively. In addition, the fauna of Zone C contains several species that otherwise occur in the upper Eocene Jackson formation of the southern United States. Clark believes that the fauna of this zone is of upper Jacksonian age, and that both the Saman and Chira shale faunas should also be referred to this horizon.

Notable among all of these faunas are a number of elements that make their first appearance here and have not been found in any other Eocene provincial fauna. Many of these elements later become of world-wide distribution, and some are still living. Clark concludes that these western South American Eocene faunas were rather isolated, particularly in pre-Zone C time, and that evolution was taking place independently within the area. Even when it was possible for the Jackson faunal elements to migrate into the area, there was no concurrent migration from the Colombian region northward into the Gulf Coastal zone. The large number of new genera and subgenera described (5 genera and 3 subgenera of gastropods, and 3 genera of pelecypods) reflects the indigenous character of the fauna.

Nine species of corals are described by Durham. Eight are from deposits containing the Zone C molluscan fauna, one is from Zone B. Four are shallow water reef-forming colonial types, the others are solitary forms.

H. E. VOKES

MOLLUSCA OF THE TERTIARY FORMATIONS OF NORTHEASTERN MEXICO. *Memoir 11.*

By Julia Gardner. The Geological Society of America, New York. $3.25 (paper). xi + 332 pp.; 28 plates. 1945.

The Tertiary molluscan faunas of the Coastal Plain area of the United States have been well known for many years, and those of the Tampico embayment of Mexico have also received much study. The intervening area, the coastal plains of northeastern Mexico, have been generally neglected. Recent petroleum investigations within this region, however, have resulted in rather extensive collections of fossil invertebrates. These were submitted to Julia Gardner by the companies concerned, and the results of her studies have been gathered into this comprehensive report. Collections from more than 400 separate localities were studied in its preparation.

Introductory to the systematic descriptions is an excellent summary of the stratigraphic section exposed in the area. It reveals the presence of a relatively complete, and fossiliferous section ranging from Paleocene to middle Miocene in age, with only one gap, there being no equivalents of the upper Wilcox, Hatchetigbee formation. In general, the formations are but a continuation of those exposed in the South Texas coastal plain area and Texan stratigraphic names have been applied to the Paleocene and Eocene formations. The Mexican Oligocene and lower Miocene sections are more complete than those of the South Texas region.

The systematic paleontology includes the description or discussion of 83 species of pelecypods, with 89 other forms recognized as being present, but too poorly preserved for description or certain identification. The gastropods include 125 species, plus 75 others that are too poorly preserved for recognition; 3 cephalopods, 5 scaphopods, 1 "Chaetopoda," and 1 insect are also recognized. Three new genera, 2 new subgenera, and 2 new sections are described.

In stratigraphic arrangement, the Paleocene fauna includes 28 species, with 15 others too poorly preserved for certain identification; the lower Eocene, 17 and 12 species in these respective categories; the middle Eocene, 104 and 59; upper Eocene, 28 and 22; the Oligocene, 44 and 35; and the lower and middle Miocene, 11 and 22 species in these respective categories.

The full-tone plates are excellent, and with the full descriptions and stratigraphic notes combine to make the work a notable milepost in our knowledge of the geology of the land south of the Rio Grande.

H. E. VOKES

EVOLUTION OF THE HORSE BRAIN. *The Geological Society of America, Memoir 25.*

By Tilly Edinger. The Geological Society of America, New York. $2.00. x + 177 pp. + 4 plates; text ill. 1948.

The evolution of the brain, particularly of the mammalian brain, is a subject of manifest and peculiar importance. No problem of evolutionary morphology commands greater interest, and none is likely to have wider ramifications in the various fields of science and of philosophy. Comparative and individual studies of brain anatomy have been numerous and voluminous, and many attempts have been made at historical, evolutionary interpretation of such data.

Until now, the usual approach to this problem has been by a comparison of the brains of recent animals, on the assumption that simpler characters, or those subjectively considered primitive, are ipso facto more ancient or ancestral. "With very rare exceptions," as Edinger justly comments, "there is in the neoneuro-

logical literature no allusion to the fact that the evolutionary stages from living shark to living man do not illustrate a historical process. At best, it is assumed that the structurally progressive sequence, into which the brains of the hundreds of extant mammalian genera can be arranged, can reveal all possible modes of brain evolution in mammals." But it is not true that "brains of . . . higher mammals evolved from any brains of the living lower mammals."

The more direct approach would be, obviously, by a study of the brains of fossil animals of different ages, or rather (since the brain, itself, is never preserved) of casts of the interiors of their skulls. In mammals and birds, and less closely in lower vertebrates, these endocranial casts do reflect with measurable fidelity the gross anatomy of the brain in different lines of descent at different times in earth history. The subject has not been neglected. Even twenty years ago Edinger could collect a great body of information on fossil endocranial casts in her classic *Die fossilen Gehirne* (Berlin, 1929). Yet these observations were phylogenetically so disparate that the evolutionary interpretation had no better base than that of the comparative anatomy of recent brains. It still was true of induction from these paleoneurological data, as Edinger remarks of neoneurological studies, that "the current conception of brain evolution is . . . not based on facts but is a working hypothesis."

The actual line of evolution of a brain, from an ancient to a modern form, had never been traced in a true, genetic sequence. We have not had even one example of real progression in brain evolution, or any check on the probability that structural advance in a single phylogenetic line might differ from structural progression in diverse contemporaneous groups.

This extremely desirable example has now been brilliantly supplied. It does not seem too strong to say that Edinger's *Evolution of the Horse Brain* marks a new epoch in the study of brain evolution and a new era in the significance and broad value of paleoneurology and of paleontology in general. Painstakingly, fully, clearly, and with the highest standards of accuracy and of caution, Edinger has described and interpreted the available facts about evolution of the horse brain in the direct line from eohippus (*Hyracotherium*) to *Equus*. The data are not complete, but they are adequate for at least five major stages, well spaced from early Eocene to Recent, and they tell a remarkably full and continuous story.

The first section of the book describes and figures the specimens, in generic and temporal sequence. A second section traces the changes in different parts and structures of the brain throughout this sequence. A final summary, relatively brief but of great and general interest, not only sums up the previous detailed findings but also brings out their broad significance. The results confirm certain conclusions previously reached from the evidence of recent brains. They require the modification of others among these conclusions, and they add much that could not be learned from the data of comparative anatomy alone.

These rich results cannot be reviewed in detail here. Perhaps the most striking discovery is the fact that the brain of eohippus was extremely primitive. In skeleton and teeth this animal had become a member of the "high," "progressive" horse family; in brain, it had barely ceased to be a reptile. The rise of the truly progressive horse type of brain, which now seems to us a diagnostic feature of the Equidae, actually occurred within that family and had nothing to do with the origin of the family. The most primitive and smallest living ungulates have far more advanced brains than eohippus, which is much closer to the opossum in this respect. Within the horse family alone, including the ancient forms, there is found almost the whole range of structural grades seen throughout the recent representatives of the whole Class Mammalia, excluding the higher primates and perhaps a few other forms. Progressive brain characters shared by recent horses and other relatively intelligent animals arose after the horses had become phylogenetically quite distinct from any other group. Horse brain evolution did not occur at a constant rate but showed periods of marked acceleration. These times of major brain change do not coincide with similar times of accelerated evolution in size, tooth or limb structure, or other non-neurological features.

These are only a few of the many provocative conclusions documented and discussed in this extraordinarily fundamental study. For anyone interested in the mammalian brain or in the course and principles of evolution in general, careful reading of this basic work is obligatory and will be richly rewarding.

G. G. SIMPSON

GLACIAL GEOLOGY *and the Pleistocene Epoch.* *By Richard Foster Flint. John Wiley & Sons, New York; Chapman & Hall, London.* $6.00. xviii + 589 pp. + 6 plates; text ill. 1947.

This work furnishes a comprehensive discussion of glaciers and glacial features based upon Flint's extensive study of recent and Pleistocene glaciation. The first part of the book is devoted to a study of glaciology, with a discussion of the mutual relations of nourishment, wastage, and flow of glacier ice and a brief description of all existing glaciers. The next part deals with glacial erosion, transportation, and deposition, and contains a rather complete coverage of the various topographic, stratigraphic, and other phenomena produced by moving ice.

Over half of the volume is concerned with the Pleistocene epoch, including an interesting chapter on the terminology of post-Pliocene stratigraphy. In addition to the Pleistocene stratigraphy, there is a short chapter

on the fossil record of this time and its implications as to the climate and the presence of land bridges connecting continents. The botanical evidence of post-Pleistocene climatic changes is taken up, and a brief description of the use of pollen profiles is presented.

The author discusses the various hypotheses which have been proposed to explain climatic fluctuations, and he concludes that a combination of topographic factors with variations in the sun's radiant energy offers the most satisfactory explanation. The last 53 pages contain an extensive bibliography.

THOMAS W. AMSDEN

FORMULAIRE TECHNIQUE DU PRÉHISTORIEN. *Ce qu'il faut Savoir sur la Géologie et la Biogéographie du Quaternaire, l'Archéologie et l'Anthropologie préhistoriques. Savoir en Histoire Naturelle, Volume XVIII. Guides Techniques du Naturaliste, Volume V.*

By Raymond Furon. Paul Lechevalier, Paris. 75 fr. (paper). 122 pp. 1945.

It is a great lack that among our scientific publications in the United States there is no such cheap yet excellent series of introductory manuals as the one to which this pocket-sized volume belongs. Here is a very compact and informative introduction to the geology, biogeography, archeology, and anthropology of the Pleistocene. Into five brief chapters Furon has packed comprehensive and quite detailed discussions of glacial and periglacial phenomena, the several European glaciations, the oscillations of sea-level and the formation of terraces; the Pleistocene fauna of Europe; the prehistoric stone industries and men; synchronisms and chronology; and methods of collecting, preserving, and studying such materials. The discussion of prehistoric human types seems least up to date and adequate. Otherwise, a student who wishes to obtain a quick and rather broad, if not too profound, knowledge of the Pleistocene will find this an excellent guide.

BENTLEY GLASS

HUMAN ANCESTRY *From a Genetical Point of View.*

By R. Ruggles Gates. Harvard University Press, Cambridge. $7.50. xvi + 422 pp. + 27 plates; ill. 1948.

This work was evidently conceived and amassed in libraries and is the product of a prodigious amount of reading and abstracting. Of particular value are the reviews of and references to the literature on the many recent finds of fossil higher primates. This enormous and previously scattered literature has been in need of compilation for some time.

The author, not being a specialist in physical anthropology, mammalian paleontology, or anatomy, quite naturally, but regrettably, cannot be expected to have acquired the first-hand experience necessary for critical selection and guarded interpretation of the widely varying studies by others. Hence this book accepts and repeats some claims which are patently unsound and introduces some hypotheses which are more daring and original than plausible or justifiable. The author's "genetical point of view," announced in the subtitle, is apparent mostly in his preoccupation with academic questions of a taxonomic nature and his willingness to assume a genetic basis for conditions which as yet can be barely assigned very tentative phylogenetic positions.

Two opening chapters discuss the Principle of Parallel Evolution and the Evolution of the Mammals, both stressing the prevalent occurrence of similar evolutionary trends among more or less closely allied forms of life and warning that "morphological similarity is not by itself a perfect measure of degree of relationship." The latter, well-justified antidote for rash conclusions does not form the leading motive in the discussions of the subsequent chapters.

The next two chapters are entitled Evolution of the Hominidae, and Head Shapes and Their Inheritance. They present interesting reviews of a large part of the newer literature dealing with these topics, though amateurish essays are listed indiscriminately with scholarly reports. These chapters include a large, summarizing family-tree in full bloom, entitled "Scheme of Higher Primate Evolution," which in some respects is so new or naive as to be startling to primatologists. According to this partly illegible picture a thick trunk of Paleocene Lemuroidea sprouted perpendicular branches supporting the recent gibbons, siamangs and orangs and another, horizontal branch led to the Tarsioidea. The latter produced a lusty offshoot as far back as the lower Oligocene, from which point one branch rose clear to the modern Ceboidea of tropical America while other branches, though locally obscured, appear to ascend to the African apes, bifurcating in Pleistocene times, and to man, in two widely separate, strong stems, bearing at the top the names "*Homo caucasicus, H. africanus,* Hottentot, and Bushman" on one stem and "*H. mongoloideus, var. americanus,* and *H. australicus*" on the other. The four former "species" or varieties claim *Eoanthropus* and Neanderthal man among their ancestors, whereas only the latter three recent human "species" are permitted to boast of such distinguished predecessors as *Australopithecus, Pithecanthropus,* and *Sinanthropus.* Old World monkeys are nowhere visible in this phylogenetic jungle, but *Dryopithecus rhenanus* seems to have evolved two times on widely separate branches and at different times. In these chapters the author also develops his theory of "gorilloid" and of "orangoid" lines of human evolution which "indicate parallel developments in the human strains, as regards the production or failure to produce superciliary and occipital tori." This theory, like certain other hazardous pronouncements on primate evolution, will be fated to reappear in new versions for as

long as bibliophiles write the broad generalizations of science while investigators are absorbed in discovering and recording new detailed facts. Gates could not resist the romantic appeal of the many sweeping, pseudo-scientific conclusions based upon endocranial casts of fossils, even though he refers briefly to Hirschler's recent, critical study which confirmed the suspicions of others that these casts rarely justify the extravagant deductions indulged in by some authors.

Five further chapters are focused on Modern Racial Types and their evolution. One of these chapters attempts to trace the descent of the Australian aborigines from *Pithecanthropus*, another chapter deals with human evolution in parts of Africa, still another with the early history of man in Europe, starting with *Eoanthropus*. The fourth of these chapters is boldly called From Sinanthropus to the American Indians, and the fifth is devoted to Polynesians, Melanesians and Negroes. These fairly comprehensive literary compositions, sprinkled with many technical details, never hesitate before those innumerable anthropological puzzles on which scholars have spent years of work only to admit that it is too early, if not too late, for final solutions. There is hardly a page without some blunt statement liable to cause specialists to groan. To mention only a few of many examples: the Ituri forest pygmies are glibly called "achondroplastic" without the slightest attempt to support such a highly questionable diagnosis. The misnamed "pygmy chimpanzee" the author unhesitatingly labels "ateleiotic" and the actually average-sized orang, recorded by Osman Hill, he honors with the title of "a contemporary giant of that species." In an earlier chapter the author has stated that the chimpanzee "is more than twice as large" as the gibbon, when "at least eight times larger" would represent the actual comparison. A list of the great many other factual errors, new or copied from the literature, is not necessary here to warn the reader that this book, with its many defects, is only an attempt to sketch man's evolution as seen by one ardent reader of the pertinent literature.

Two final chapters on Some Principles on Speciation in Primates, and on Paleontology, Speciation, and Sterility are stimulating essays on the nature of species, but they seem somewhat like *moutarde après dîner* at the end of this book. Among many interesting and valuable notes and comments one encounters unsupported and very doubtful claims in these chapters, such as: The mountain gorilla is "almost entirely terrestrial while *G. gorilla* is more arboreal. This difference in habits corresponds with the differences in the foot." "There seems no reason why the male gorilla should not cross with the female chimpanzee." Such matchmaking between a 500 lb. gorilla and a 100 lb. chimpanzee is somewhat horrifying to imagine and might at least have been tempered with a request for artificial insemination.

The very last paragraph rises to the following conclusions: "Since sterility fails as the criterion of species, we have to rely on the traditional basis of morphological difference in the discrimination of species, including man. We have already seen that many species and several genera of Hominidae have existed in the past, and it is clear that we must apply to man the same criteria of species that we apply to the apes and monkeys. Consistency in nomenclature and methods of classification thus necessitates the recognition of several species of living man." Incredible as it seems, it is still necessary to emphasize that the antiquated concept of the impossibility of crossing between different species has long ago been deeply buried under tons of unassailable facts. Among primates alone a great variety of interspecific hybrids have become known (though they are not referred to in this book) and new ones are being added rapidly wherever primates are kept captive under suitable conditions.

As indicated above, the outstanding contribution of this volume consists of the long and conscientiously prepared lists of references after each chapter, even though these lists are far from complete nor to be regarded as strictly "selected."

The author as well as the publishers are to be commended for their courage in undertaking this work on a subject which is as yet quite incompletely known, imperfectly understood, and open to constant revision to account for the rapid accumulation of newly discovered facts. As it is a quite tentative interpretation of its subject and since few technical matters are explained in popular terms, this is not a book for the layman.

A. H. SCHULTZ

BIBLIOGRAPHY AND INDEX OF GEOLOGY EXCLUSIVE OF NORTH AMERICA. *Volume 11—1945–1946.*

By Marie Siegrist and Eleanor Tatge. Geological Society of America, New York. $3.25. xviii + 474 pp. + 1 plate. 1947.

A continuation of the superb index of geological and paleontological literature started by the late John M. Nickles (cf. Q. R. B. 21: 371. 1946). A memorial sketch of Nickles is included in this volume.

GENETICS AND CYTOLOGY

L'ORIGINE DES CELLULES REPRODUCTRICES *et la Problème de la Lignée Germinale. Collection des Actualités Biologiques.*

By L. Bounoure. Preface by P. Bouin. Gauthier-Villars, Paris. 200 fr. (paper). xii + 271 pp.; text ill. 1939.

Bounoure has presented a survey of the Keimbahn problem in a book that combines the best German tradition of methodical thoroughness with an admirable

French clarity (as befits a man from Strasbourg). The first section of the book is an informative historical introduction which gives due place not only to the work of Weismann but also to that of his predecessors, Owen, Jager, and others, and more especially to Nussbaum, who fathered the theory and first supported it with facts.

The bulk of the book is devoted to a survey of the data regarding the germ cells and their origin, arranged by taxonomic groups from the protozoa to the vertebrates. Special interest naturally attaches to the illustrated chapter on Bounoure's own investigation into the origin of the germ cells in the frog. He traces the germ nuclei and the cytoplasmic germ cell determinants from their initial position near the vegetal pole of the uncleaved egg by special staining reactions and by radiation techniques.

The concluding chapters discuss some of the general problems involved. It may be, as Bounoure maintains, that true dedifferentiation with a return of totipotency is a biological impossibility, but many will find it difficult to believe that this has become a closed question. Others may object to a certain teleological phraseology, but that is confined to the end of the book. There is a rather summary treatment of the situation in plants and in those invertebrates in which no early segregation nor clearly demarcated germ line is apparent. This lack is doubtless made up in the author's companion volume, *Continuité germinale et reproduction agame*, which was in press when this one was published.

The present volume will probably remain as the definitive survey of the germ cell problem from its origins up to the time when it becomes merged with the general biochemical problems of differentiation. The bibliography is the most complete ever published (unless there is one in Russian unknown to the reviewer). Bounoure ends with a quotation from John Beard, himself one of the early workers in this field, that places the germ cell theory in its proper perspective. "To us as embryologists and men the formation of an embryo has appeared to be everything, the history of the germ-cells a secondary item of no particular moment. Nature, on the other hand, reverses the relative importance of the two, setting the germ-cells on the place of honour, as linking the remote past with the distant future."

GAIRDNER MOMENT

ANIMAL GENETICS AND MEDICINE.

By Hans Grüneberg, with a foreword by Sir Henry Dale. Paul B. Hoeber, New York and London. $5.50. xii + 296 pp.; ill. 1947.

Animal geneticists have analysed, with various degrees of completeness, the genetic causes and the developmental histories of a large number of abnormalities in laboratory rodents. Medical scientists have had to deal with abnormalities in human beings, abnormalities which in many cases closely resemble those in rodents. Too often, the labors and objectives of these two groups —the geneticists and the medical scientists—have been unknown to each other.

Hans Grüneberg in this book has undertaken to draw these two fields together. For this task he is uniquely qualified, having had formal training in both, having been one of the chief contributors to research on animal variations of medical interest, and possessing a highly critical approach to scientific discoveries and theories. The first three chapters are devoted to discussing the concepts required for a successful union of animal genetics and medicine, namely, the difference between the statement that a disease is gene-controlled and a statement that the gene alters some specific mechanism early in development, the interplay of heredity and environment in the development of a disease, the advantages and limitations of using experimental animals for drawing inferences about human teratology, and the principles of developmental genetics. In the remaining chapters, except the last, cases of abnormal development in mice, rats, rabbits, guinea pigs, and *Peromyscus* are discussed in as much detail as the available facts and space warrant. The cases are drawn from defects of the central nervous system (pseudencephaly, syringomyelia, atocephaly, congenital hydrocephalus, brachydactyly, ataxia, epilepsy), the ear, the eye (anophthalmia, microphthalmia), endocrine organs (pituitary dwarfism), the blood (anaemia, antigens), the skeleton (short tail and other tail abnormalities, chondrodystrophy, polydactylism), the digestive tract (hare lip and cleft palate), the urogenital system, and the skin. Grüneberg is careful not to claim too much for the parallels between the animal and human cases, but he does persistently remind the reader that much more is to be learned about medical variations by the thorough analysis of similar variations in laboratory animals.

For the geneticist, this book may open up an entirely new view of the importance of his studies on the small vertebrates. For the medical scientist, it may present some hope of understanding the developmental mechanics lying behind the human variations he deals with daily. The book emphasizes the potential advances of the future as much as the notable accomplishments of the past.

EARL L. GREEN

IDENTICAL CATTLE TWINS AND CAUSES OF SPOTTED PATTERNS.

By Alan Deakin. Published by the author, Ottawa-Prescott Highway, Westboro, Ontario. 70 cents (paper). 16 pp. 1944.

CAUSES OF THE ZEBRA AND OTHER PATTERNS.

By Alan Deakin. Published by the author, Ottawa-

Prescott Highway, Westboro, Ontario. 70 cents (paper). 17 pp. 1944.

CAUSES OF COLOR PATTERNS IN PLANTS AND AN INHIBITING FACTOR HYPOTHESIS.

By Alan Deakin. Published by the author, Ottawa-Prescott Highway, Westboro, Ontario. 70 cents (paper). 24 pp. 1944.

ANIMAL GENETICS AND THE INHIBITING FACTOR HYPOTHESIS.

By Alan Deakin. Published by the author, Ottawa-Prescott Highway, Westboro, Ontario. 70 cents (paper). 24 pp. 1945.

A CRITIQUE OF MAJOR BIOLOGICAL PRINCIPLES AND THEORIES.

By Alan Deakin. Published by the author, Ottawa-Prescott Highway, Westboro, Ontario. $1.00 (paper). 37 pp. 1946. $3.50 for all 5 papers.

GENERAL PHYSIOLOGY

BIOELECTRIC FIELDS AND GROWTH. *With a Bibliography of Continuous Bioelectric Currents and Bioelectric Fields in Animals and Plants.*

By E. J. Lund and collaborators; bibliography by H. F. Rosene. The University of Texas Press, Austin. $6.00. xiv + 391 pp.; ill. 1947.

This volume, appearing from the laboratory of Lund after a decade of silence, will be welcomed by everyone concerned with the problems of growth. A word of warning, however, should be posted at the outset. The reader must not be misled by the title into expecting a connected, logical presentation of the electrical theories of growth and the facts relevant to them. The authors did not intend to do the kind of thing Morgan did in his classic *Theory of the Gene.* On the contrary, this book is a series of research papers by Lund and a dozen co-workers presenting a mass of important new data and new techniques relating to bioelectric potentials. There is considerable discussion, although the authors state very frankly that "the significance of the concept of maintained bioelectric fields . . . cannot alone be judged from the facts presented in this volume but must be evaluated in relation to numerous other facts which have previously been published."

The first section of the book deals with the pattern of electric potentials measurable on the surface of individual cells of *Pithophora* (a filamentous alga with a basal holdfast), and in the simple epithelial systems represented by the mantle of the fresh-water clam and the *Avena* coleoptile. The apical end of a *Pithophora* cell is positive in the external circuit with respect to the basal end. The future plane of cell division can be detected long before the appearance of a cellulose cell wall. The origin of the electrical energy is held to be the living protoplasm. In the work on the clam mantle, and throughout the book, there is considerable emphasis on the "Principle of Summation" in the production of a given potential. The following chapter, on The Electric Correlation Field and Its Variations in the Coleoptile of *Avena sativa*, and the following section, which analyses the effects of gravity on the electric field of the coleoptile, (some 97 pages in all) repeat, extend, and take issue with the work of Clark, Cholodny, Brauner and Amlong, and others in this field. In correlating the changes in electric polarity in coleoptiles with auxin theory, evidence is presented that the "transverse polarity of the cells, which results in lateral transport of auxin" (to use the words of Went and Thimann) is, in fact, an electrical polarity.

The third section of the book reinvestigates the "spontaneous" variations in potentials recorded for the onion root tip. These variations are shown to be greatest in regions of high mitotic activity. It is suggested that such fluctuations may be related to the "brain waves" of Hans Berger.

The fourth and longest section is devoted to the effects of externally applied currents on growth and polarity in onion roots and *Avena* coleoptiles. The more than twenty-five conclusions and the great mass of data do not permit easy condensation. It is shown, inter alia, that "three distinct sets of bioelectric phenomena must now be recognized in electrically polar root cells." It also appears that the "inherent polarity current" generated by a root is from four to ten times greater than would be required to move free ions in or around the cells and thus "could affect the rate and orientation of growth of cells." *Avena* coleoptiles were found to bend towards "the positive pole of the current applying circuit," but the interpretation of this fact is obscure. The scant two pages on the control of orientation and growth in reassociating cell masses of *Obelia* add little or nothing to the previous findings of Barth or of Lund himself.

The final section, on biocoulometry, describes for the first time the use of the iodine coulometer in electrophysiology, and also the procedure for continuous measurement of electric current by a microammeter. With the frog skin used, it was found that the output of electrical energy amounted to a minimum of 1% to 2% of the total energy output from all metabolic processes. This amounts to a minimum of at least 30% "coulomb efficiency," defined as the ratio of electrical output in coulombs to the coulomb equivalent of the total oxygen consumed. The high value obtained is regarded as further evidence that redox systems "in flux equilibrium are the normal mechanisms of maintained bioelectric currents in polar cells."

Undoubtedly this is a remarkable contribution to the literature on the biophysics of growth. Potentially important new techniques have been developed, and older techniques have been utilized to secure a host of new facts. The very elaborate and often exquisitely

refined methods used are presented with an attention to detail that clearly indicates the author's hope that others will repeat and extend this work. For this reason as well as because the work itself represents an enormous amount of the most painstaking effort, it is truly a pity that it was not presented in a clearer, more manageable form. For a reviewer must admit that the language is too often Germanic in verbosity, and the arguments too often facile rather than convincing. On one page, for example, the reader is asked to "note that the polarity of the system as a whole depends upon the algebraic sum of all the constituent polarities." Further down on the same page he is told "It will also be evident from the diagrams that the region of highest electrical potential determines or controls the orientation of the bioelectric field or the electric polarity of the system as a whole. From this it is evident that the fundamental biophysical problem is how the electric polarity of the field becomes established and how it is maintained." To many readers this will seem perilously close to arguing in a series of circles. And for most readers, it is not enough to say simply, "It will also be evident from the diagrams," nor to slip without more ado to the "fundamental biophysical problem." The undeniable facts are there, and they deserve to be presented and discussed in adequate and unequivocal language.

The value of the book is enhanced by Rosene's bibliography of publications on continuous bioelectric currents and bioelectric fields in animals and plants. It includes 1,406 titles and a subject index.

GAIRDNER MOMENT

GENERAL AND SYSTEMATIC BOTANY

THE GRASSES OF BURMA.

By D. Rhind. Published under the authority of the Government of Burma, Baptist Mission Press, Calcutta, India. Rs. 5/- or 7s. 6d. 99 pp. 1945.

The author, formerly economic botanist at the Mandalay Agricultural College, prepared this work in India after the Japanese invasion of Burma. Many unpublished scientific data were lost in the invasion. In December, 1941, representative sheets of grasses were sent from the Mandalay Agricultural College to Dr. N. L. Bor, Dehra Dun, India, for safe keeping and were later transferred to the Lloyd Botanic Garden, at Darjeeling. This enumeration of the grasses of Burma is based on the specimens from Mandalay, on the Burma collections in Dehra Dun and Darjeeling, and on the bamboo collections in the Royal Botanic Gardens, Sibpur, Calcutta. The object in publishing a necessarily incomplete enumeration was largely to save the accumulated knowledge from further loss. Burma has not been extensively explored except for its economic plants. Relatively little had been published on the grasses of Burma and that little is scattered, mostly out of date, and only available in large libraries. "Burma is a land wreathed in bamboos. The Burman's whole existence is bound up with bamboos. They are everywhere and enter into almost every phase of life and commerce." The bamboos, of which 17 genera and 69 species are described (besides 16 doubtful species listed) are more fully treated than the smaller grasses. There are 132 grass genera, divided into 20 tribes. Keys are given to tribes, genera, and species, and those species of which descriptions are not readily available in current works are described. Notes on habitat and distribution are added. Genera to be expected in Burma are included in the keys, and names, in parentheses, and notes on species found across the borders are added. A list of fungi recorded on grasses (the host given where known), compiled by L. N. Seth and B. B. Mundkur, a glossary, bibliography, an extensive list of vernacular names, and a good index complete a very useful work. The introduction gives a general account of the grass flora of the country.

AGNES CHASE

FLOWERS OF PRAIRIE AND WOODLAND.

By Edith S. Clements. The H. W. Wilson Company, New York. $2.25. iv + 83 pp. + 25 plates. 1947.

This is a non-technical book about the flowers of the prairies and woodlands of the United States, with particular emphasis given to those of the Middle West. The twenty-four beautifully colored plates, previously published in the National Geographic Magazine, are done in the manner of the older botanical journals of the early 1800's, and together with the simple text, they provide an attractive and useful means of becoming acquainted with the native flora. Botanical jargon has been eliminated entirely, without, however, rendering the volume awkward or inadequate even to the technically-trained individual. It has much to recommend it.

C. P. SWANSON

LET'S LOOK AT THE PLANT WORLD. *An Observational Record of the Forces and Factors Behind the Phenomena of Plant Life.*

By David S. Marx. The Botanic Publishing Company, Cincinnati. $3.00 (paper). 16 pp. + 150 plates. 1942.

Like other volumes by the same author, this is a loose-leaf, mimeographed book, written for the teen-ager, and illustrated in black-and-white ink prints. It is concerned principally with the structure and function of the various plant parts, simply presented, and profusely illustrated. Except for the leaf prints, which are excellent, the illustrations of fruits and inflorescences are

poor and of little use for purposes of identification. While of some value for supplementary reading on a high school level, the book cannot be recommended as a textbook because of the inadequacy of the subject matter for teaching purposes.

C. P. SWANSON

THE AMERICAN BOOK OF THE WOODS. *Prints and Uses of 256 Trees, Shrubs, Herbs and Vines.*

By David S. Marx; ill. by Philip D. Spiess and Philip Pfeiffer. The Botanic Publishing Company, Cincinnati. $2.50 (paper). 27 pp. + 45 plates. 1940.

The enjoyment of our natural surroundings increases as we become better acquainted with its component parts, and the uses which have been, or can be, made of them. The recent and much-needed emphasis placed upon the conservation of our woodlands, our fields and streams, and our wild plant and animal life, accentuates the point that only through proper education can these facts be brought home. This volume, presented in loose-leaf, mimeographed form, and designed for the teen-ager, is an admirable attempt to give to the younger generation a panoramic view of American plants and their place in our everyday life. It should be an excellent source book for nature-study groups, as it contains the leaf prints and the uses of over 250 trees, shrubs, herbs, and vines. The sections of the book are arranged according to the uses made of the plants. To be effective, however, the material would have to be reinforced by access to other sources of information, for the presentations are too sketchy to be of use by themselves.

C. P. SWANSON

LEARN THE TREES FROM LEAF PRINTS.

By David S. Marx. The Botanic Publishing Company, Cincinnati. $1.25 (paper). v + 38 plates. 1938; 1945.

To call plants by name, as well as to enjoy their beauty, is a satisfying experience. Since the floral parts of many of our native and introduced trees are inconspicuous, their readily recognizable hallmarks are their leaves. The leaf prints, of natural size, shape, and venation, mimeographed on detachable sheets, provide accurate examples for comparative purposes of identification. The usefulness of such a leaf-print system is considerable to a beginner, but value of the book is marred by lack of a simple and workable key. The distinguishing features of the gymnosperms, as compared to the clarity of the angiosperm leaf prints, are such as to make them useable only with difficulty.

C. P. SWANSON

THE AMERICAN SPECIES OF HYMENOPHYLLUM SECTION SPHAEROCIONIUM. *Contributions from the United States National Herbarium, Volume 29, Part 3.*

By C. V. Morton. United States National Museum, Smithsonian Institution, Washington, D. C. 30 cents (paper). viii + pp. 139–201. 1947.

This revision of a group of American ferns lists 52 species, of which 12 are new. New varieties, 7; new forms, 1.

A PRELIMINARY SURVEY OF BRYOLOGICAL RESEARCH IN QUEBEC. *Contributions de l'Institut Botanique de l'Université de Montréal, Number 61.*

By James Kucyniak. Institut Botanique, Université de Montréal, Montréal. 25 cents (paper). Pp. 127–140. 1946.

ECONOMIC BOTANY

VIRUSES AND VIRUS DISEASE OF PLANTS.

By Melville Thurston Cook. Burgess Publishing Company, Minneapolis. $4.00 (paper). x + 244 pp.; ill. 1947.

Published in the author's 78th year, this book is a fitting climax to his fifty years as teacher and investigator, with much of this time devoted to the viruses. Cook is one of the pioneers of plant pathology. He has observed and participated in the history of this young science from its beginnings in America. He is more biologist than many phytopathologists in these days when chemistry and physics dominate the scene and when there is danger of losing sight of the fact that the basis of understanding viruses is their biological activity as agents of disease. The book must be appreciated in the light of these facts.

The pattern of the book resembles Bawden's *Plant Viruses and Virus Diseases* or Smith's *Recent Advances in the Plant Viruses*. As in these, the reader will not find thorough outlines or discussions of particular viruses and the diseases they cause, but rather a very extensive assembly of facts, based on a bibliography of some 1400 titles, arranged according to the principles of plant virology, and "intended as a historical review and guide." It presents the most comprehensive panorama of the development of plant virology from 1576 to 1940 available. The false scents and blunders of early virology are duly recounted. They show the gradual building up of the subject, and in some cases they may prevent students repeating errors of the past. There are occasional section summaries but the author is "more interested in studying and understanding the works of others than in entering into controversies" and is reluctant to intrude his own viewpoints lest he "prejudice the students in their progress."

Particularly valuable are the purely biological chapters that deal with plant reactions to viruses and virus transmission, which together constitute half of the text. Other chapters concern the nature and properties of plant viruses with relatively little emphasis on physical and chemical properties. The very detailed table of contents compensates for a rather limited index. A unique feature is the 6-page chronology of landmarks in plant virus research.

K. STARR CHESTER

THE GREAT FOREST.

By Richard G. Lillard. Alfred A. Knopf, New York. $5.00. x + 400 + xiv pp. + 24 plates; text ill. 1947.

This is a remarkably well-told story of the great forest that the early settlers found when they landed in America. It is also the story of the many ways in which the forest served these people and later the nation, and, in turn, a story of the treatment that the forest received. It is a fascinating story which leaves the reader with the conviction that "this is the way it was." The subject is large, and the account covers a period of more than 300 years.

The first part (Chapter titles: The Backwoods System; Hunting in the Wilderness; Bloody Course of Empire; Sunshine on the Land; Cabin in the Clearing; Fever and Fire) deals with the life of the settler, the hunter, and the Indian fighter in the Great Forest. Here is real Americana!

The second part (Subsidy for Independence; Broad Arrow; Harvest for Progress; Round Forties; Baronies in the Making; Lumberjack, Riverhog and Raftsman) traces the rise of the lumber industry and what happened to the Great Forest.

In the third part (Rebellious Countryside; Crusade for Conservation; Protest from Labor; Forest in the Machine Age) is found an excellent and accurate account of the beginning and development of the conservation movement.

A list of large American trees, selected from the records of the American Forestry Association, is included in the Appendix. Data on circumference, crown spread, height, and location of specimens of 79 species are presented. Sources of principal quotations, an extensive bibliography, and an adequate index add to the value of the work as a reference. The student of conservation, the historian, and the general reader will find in *The Great Forest* an authentic and absorbing account of how people and forests have gotten on together in America.

H. J. LUTZ

GUARDIANS OF THE FOREST.

By Stacy Klingersmith. Dorrance and Company, Philadelphia. $3.00. 175 pp. + 25 plates. 1947.

For several years the writer of this book has devoted her time to teaching young boys and girls to appreciate trees and forests. A Tree Club, said now to have branches in ten states, was formed by Miss Klingersmith to stimulate interest in the conservation of trees.

Guardians of the Forest is written in the form of a diary. The style is conversational. Each of the thirteen chapters is based on experiences of the writer and a group of youthful Nature lovers during walks in the woods of southern Michigan. The excellent full-page illustrations are placed together at the beginning of the book.

This book will probably have its principal appeal to young boys and girls, and to adults who serve as leaders of Boy Scout or Girl Scout groups.

H. J. LUTZ

FRAGRANT HERBS. *The Botanic Handy Books.*

By David S. Marx. The Botanic Publishing Company, Cincinnati. 25 cents (paper). 64 pp.; ill. 1943.

The old-fashioned garden was never without its herbs, and the fragrance and flavor they imparted to culinary offerings helped to offset the monotony of the colonial vegetable diet. Fifty-five of those fragrant herbs are pictured in this handbook, the leaf illustrations affording a means of ready identification. The uses to which the herbs can be put are also mentioned, but only in passing.

C. P. SWANSON

TRANSMISSION OF POTATO VIRUS DISEASES. *5. Aphid Populations, Resistance, and Tolerance of Potato Varieties to Leaf Roll. Bulletin Number 196.*

By J. G. Bald, D. O. Norris, and G. A. H. Helson. Council for Scientific and Industrial Research, Melbourne, Commonwealth of Australia. Free upon request. 32 pp. 1946.

PLANT MORPHOLOGY

AN INTRODUCTION TO PLANT ANATOMY. *McGraw-Hill Publications in the Botanical Sciences. Second Edition.*

By Arthur J. Eames and Laurence H. MacDaniels. McGraw-Hill Book Company, New York and London. $4.50. xviii + 427 pp.; ill. 1947.

The issuance of the second edition of a book 22 years after its first printing, and in a field of science in which it enjoys an almost monopolistic coverage, is ample evidence of the maturity and static quality—one might almost say, senility—of plant anatomy, a statement

which, in these days of experimental approaches, might be made of almost any field of endeavor which is largely descriptive. This is borne out by the fact that the authors, in rewriting the text, have found it unnecessary to alter, in any way, the original chapter headings,—new material, such as it is, being readily incorporated into the earlier data. The only exception is that the historical chapter, for reasons of space, has been omitted. The paucity of recent work in some of the chapters (e.g., the chapter on the stem has no references later than 1930) is clearly indicative of the lack of interest in the field, drawing, as it does, fewer and fewer of the younger botanists into its fold.

The volume, however, is indispensable for any botanist, since it contains the basic information that underlies any experimental studies in plant anatomy. This is particularly true for those interested in anatomical evolution, taxonomic modifications as illustrated in cellular structures, and in experimental morphology. It is encouraging therefore to note the expansive treatment given the chapters on the cell, the meristem, and the floral anatomy, for it is probably in these special fields that future anatomical research will be most productive.

C. P. SWANSON

PLANT PHYSIOLOGY

THE USE OF AUXINS IN THE ROOTING OF WOODY CUTTINGS. *Maria Moors Cabot Foundation, Publication Number 1.*

By Kenneth V. Thimann and Jane Behnke. Published under the auspices of the Harvard Forest, Petersham, Massachusetts. $1.00 (paper). iv + 272 pp. 1947.

In this compilation the authors have brought together in tabular form all available data of a quantitative or semi-quantitative nature pertaining to the effect of auxins on the rooting of woody plant cuttings. Included are some unpublished data from the authors' laboratory. The bibliography covers the literature to June 1947 and contains 291 references. Thus the book exceeds in scope all previous summaries of its kind.

FRANCIS HAXO

GENERAL AND SYSTEMATIC ZOOLOGY

TEXTBOOK OF GENERAL ZOOLOGY. *Fourth Edition.*

By Winterton C. Curtis and Mary J. Guthrie. John Wiley & Sons, New York; Chapman & Hall, London. $4.50. xx + 794 pp.; ill. 1947.

This excellent and widely known college textbook of zoology (cf. Q. R. B. 9: 111. 1934; 14: 244. 1939) has again been carefully revised and brought up to date. The influence of recent revision of the invertebrate phyla is apparent in such changes as the replacement of the Nemathelminthes and Rotifera by the new composite phylum Aschelminthes. A chapter on the comparative structure of invertebrate systems has been added. There is ample evidence that the work of revision has been painstaking and thorough.

BENTLEY GLASS

TEXTBOOK OF ZOOLOGY. *Second Edition.*

By George Edwin Potter. The C. V. Mosby Company, St. Louis. $5.00. 948 pp.; ill. 1947.

In this new edition (cf. Q. R. B. 14: 244. 1939), chapters on the Annelida (J. Teague Self), Genetics and Eugenics (Frank G. Brooks), The Endocrine Glands and Their Functions, and the Phylogenetic Relations of Animal Groups have undergone the main revisions. A short chapter on Mammalian Development has been added. The major portion of the book (28 chapters) is devoted to a rich survey of the animal kingdom, group by group, in detail beyond that of comparable textbooks. But other aspects of animal biology have not been neglected. The over-all treatment of evolution is the weakest element of the book. The illustrations, particularly the halftones, suffer from the quality of paper used.

BENTLEY GLASS

LABORATORY TEXT IN ELEMENTARY ZOÖLOGY.

By Clair A. Hannum and William H. Brown. Stanford University Press, Stanford University, California; Humphrey Milford, Oxford University Press, London. $1.50 (paper). viii + 180 pp.; ill. 1939.

The contents of this manual are divided into five sections, the first of which is an introduction to general laboratory procedure. The second section introduces the student to the microscope, its parts and its use. A typical cell (liver of *Necturus*) and cells undergoing mitotic division (*Ascaris*) are the first two subjects studied by the student. The third section is entitled a general survey of an animal (frog) and requires work on the external and internal anatomy. Included here are simple problems and exercises in digestion, diffusion, and muscle action. The fourth part is a general survey of the animal kingdom, with the usual descriptions of the common laboratory types. The last part discusses the principles of classification and includes a key to the phyla and classes. There is an index and an appendix of reagents used in the experimental work. Anyone interested in this method of organization and presentation will find this manual useful.

HENRI C. SEIBERT

GENERAL ZOOLOGY LABORATORY GUIDE. *Third Edition.*

By J. E. Wodsedalek. Wm. C. Brown Company, Dubuque, Iowa. $2.75 (paper). vi + 250 pp.; ill. 1946.

This workbook is intended for a full year's course in general zoology at the college level. The writer, reflecting the opinions of the Zoology Department of the University of Minnesota, believes that too much emphasis is placed on laboratory drawings, and he therefore alleviates this burden by providing numerous drawings and diagrams. Many other figures are also included, being intended to clarify the parts of laboratory exercises that have proved to be perennial stumbling blocks and have consumed time out of all proportion to their real value. Since there is such a liberal provision of drawings, grades must necessarily be based upon what the student has comprehended and not drawn; this is accomplished by practical examinations. The sequence adopted begins with elementary cytology and histology and works up the phylogenetic scale, using several examples in each phylum. The chordates include amphioxus, lamprey, shark, frog, fetal pig, and elements of chick embryology. The drawings are good and the entire guide gives evidence of being the culmination of a long and thoughtful experience.

HENRI C. SEIBERT

A LABORATORY GUIDE FOR GENERAL ZOOLOGY *With the Mammal as the Vertebrate Type.*

By Raymond M. Cable and Clarence J. Goodnight. Burgess Publishing Company, Minneapolis. $1.25 (looseleaf pages). v + 51 pp. + 30 plates. 1947.

Faced with the problem of offering a one-semester course in general zoology with one 3-hour laboratory period per week, the writers have prepared this manual to meet such a requirement. The procedure adopted differs from standard practices in most beginning zoology laboratories. The student first studies the organ systems (skeleton of the cat; internal anatomy of the rat), then proceeds with microscopic investigation of the cell, mitosis, gametogenesis, etc. This is followed by studies of the protozoa, flatworms, annelids, and arthropods, concluding with a survey of the animal kingdom. The second half of the manual contains a series of drawings of parts observed, which the student is required to label. At this point the student can be tested by having him label the drawings from memory or with the specimen in front of him. This procedure requires that the plates be turned in at the first period and redistributed to the students as needed. The drawings are well executed, and the manual will be useful to those who desire to follow its method of presentation.

HENRI C. SEIBERT

A MONOGRAPH OF THE EXISTING CRINOIDS. *Volume 1, The Comatulids. Part 4b.—Superfamily Mariametrida (concluded—the family Colobometridae) and Superfamily Tropiometrida (except the families Thalassometridae and Charitometridae). Smithsonian Institution, United States National Museum Bulletin 82.*

By Austin Hobart Clark. United States National Museum, Smithsonian Institution, Washington, D. C. $2.75 (paper). viii + 473 pp. + 43 plates. 1947.

A. H. Clark is writing a series of comprehensive monographs on the living crinoids, of which this is the fourth part. All of these to date, including the present volume, deal with the comatulids or unstalked crinoids. The present paper contains a systematic discussion of 5 families, the Colobometridae, Tropiometridae, Calometridae, Ptilometridae, and Asterometridae. Twenty-eight genera are described, of which 2 are new.

THOMAS W. AMSDEN

CATALOGUE OF NORTH AMERICAN BEETLES OF THE FAMILY CLERIDAE. *Fieldiana: Zoology, Volume 32, Number 2.*

By Albert B. Wolcott. Chicago Natural History Museum, Chicago. 75 cents (paper). Pp. 59–105. 1947.

The author, a well known authority on the North American Cleridae, has prepared an excellent catalogue which will be very useful for students working with this family. The introduction mentions former lists in order of publication, and gives an explanation for some changes in classification. The family Cleridae is divided into 7 subfamilies, 34 genera, and 267 species, as well as a number of varieties. References are given for all genera, species, varieties, and synonyms. Genotypes are given under genera, and the distribution is given for each species. A complete systematic bibliography for North American forms is given in the back, and also an index.

JOSEF N. KNULL

REVIEW OF THE WEEVILS OF THE TRIBE OPHRYASTINI OF AMERICA NORTH OF MEXICO. *Proceedings of the United States National Museum, Volume 96. Publication Number 3207.*

By A. C. Davis. United States National Museum, Smithsonian Institution, Washington, D. C. Paper. Pp. 483–551; ill. 1947.

A GENERIC REVISION OF THE ICHNEUMON-FLIES OF THE TRIBE OPHIONINI. *Proceedings of the United States National Museum, Volume 96. Publication Number 3206.*

By R. A. Cushman. United States National Museum, Smithsonian Institution, Washington, D. C. Paper. Pp. 417–482 + 8 plates. 1947.

ALASKA'S ANIMALS AND FISHES.

By Frank Dufresne; illustrated by Bob Hines. A. S. Barnes and Company, New York. $5.00. xviii + 297 pp. + 12 plates; text ill. 1946.

Here is an exceptionally fine book, the first complete work of its kind to cover the animal and fish life of Alaska. Written in an engaging style, it imparts the savor of the outdoors while describing the appearance, habits, and distribution of Alaska's mammals and fishes. The reviewer concurs enthusiastically with Alexander Wetmore's statement in the Foreword that "the present volume is one to have on any naturalist's library shelf, one that will be appreciated by nature lovers everywhere, whether or not they have traveled in our great territory in the north, or whether or not they ever expect to go there, a book that will be read and enjoyed for its direct and vivid presentation as well as for its authoritative information on its subject." It is a book that should also interest fishermen and big game hunters, for it contains much valuable information bearing directly on those sports.

Beginning with a description of Alaska, its geography and climate, the author progresses to a consideration of Alaska's animals of the Pleistocene and then discusses in turn the big game, the fur trade, the rodents, shrews, bats, seals, whales, porpoises, and fishes. For each species described there is given such information as the range, nesting or breeding habits, care of the young, population densities, and varied ecological information bearing on predators, aggregations, migrations, hibernation, changes in pelage, size attained, etc.

The volume is beautifully and refreshingly illustrated by Bob Hines with plates in color and numerous pencil and pen-and-ink drawings. It is well bound and handsomely printed.

V. G. DETHIER

ANGLER'S CHOICE: *An Anthology of American Trout Fishing.*

Edited by Howard T. Walden II. The Macmillan Company, New York. $3.75. viii + 326 pp. 1947.

If you are a biologist who is also a fisherman, especially a trout fisherman, you will enjoy this anthology; if you are not, you will not.

The thirty selections are varied enough to include material from Bliss Perry's "Fishing with a Worm," Peterson's "No Life So Happy," and Ed Zern's "To Hell With Fishing," along with more technical pages from George La Branche, Ray Bergman, and others.

GAIRDNER MOMENT

FISHES OF THE GREAT LAKES REGION. *Cranbrook Institute of Science Bulletin Number 26.*

By Carl L. Hubbs and Karl F. Lagler. Cranbrook Institute of Science, Bloomfield Hills, Michigan. xii + 186 pp. + 26 plates; text ill. 1947.

Previously published under the title *The Fishes of the Great Lakes and Tributary Waters*, this handbook has been revised with a view to making it more useful to a less specialized audience. Many black-and-white illustrations have been added, as well as the color plates, and the general text has been augmented. Basically the book is an illustrated key, but each species represented is discussed in a short paragraph summarizing its distribution and known natural history. There is a section on anatomical features, methods of counting, measuring, collecting and preserving, a bibliography, and an index. A map of the Great Lakes basin is used for the end papers. The work is concisely and admirably done, and the long narrow shape of the volume, while perhaps just a bit awkward to be carried in a coat pocket in brushy country, makes it handy for use on the table beside the specimens.

J. W. HEDGPETH

AMPHIBIANS AND REPTILES OF THE PACIFIC STATES.

By Gayle Pickwell. Stanford University Press, Stanford University, California. $4.00. xiv + 236 pp. + 1 plate; text ill. 1947.

A recent reviewer, writing in a journal devoted exclusively to herpetology, valued this book as the "last word on the area covered—Washington, Oregon, and California," and the blurb on the jacket of the book states that it is a "complete reference guide to the amphibians and reptiles of the Western area." Others, particularly those taking a comparative and longer-range view of biological literature, might be inclined to couch their evaluations in more moderate terms.

West Coast youngsters interested in natural history will find this book tremendously appealing and influential. Many of our top-notch contemporaneous naturalists, in their younger days, were brought up on, and had a high regard for, Ditmar's books; Pickwell's book may serve the same purpose for the more restricted area it covers. High school students, boy scouts, college undergraduates, and others—those interested in vertebrate natural history—will probably comprise the book's widest audience.

The present work is divided into eight parts. The Introduction is short and emphasizes the use of the terms poikilothermic and homoiothermic and contrasts their meanings with earlier, and more loosely-used, terms. The next part, Amphibians of the Pacific States, is essentially an annotated systematic list devoting about a paragraph to each form; there are over 25 kinds of salamanders and a like number of anurans. The section on the Reptiles of the Pacific States similarly discusses about 10 turtles, 50 lizards, and 75 snakes. There then follow two short chapters, one on

the life habits of the amphibians of the Pacific States and the other on those of the reptiles. Topics considered include: habitat, food, reproduction, growth, and enemies. A 5-page chapter on the collecting, handling, and care of specimens precedes the collection of plates that forms the seventh part of the book. The plates show many of the species, some habitats, and selected views of various phases of the life history of several of the forms. The final chapter, titled Appendix, is a nearly 50-page key illustrated with a number of line drawings of key characters. The book is concluded with a Glossary, Bibliography (of about 115 items), and Index.

It is difficult to appraise this book, as it has many nice features and a few unfortunate ones. The Preface was quite refreshing, inasmuch as a good deal of the information about the preparation of the book was succinctly summarized and acknowledgments were freely given. In addition to the ranking herpetologists of the West Coast, thanks were offered also to a great many students and helpers whose names, otherwise, would probably never grace the pages of scientific literature. The discussions in the systematic section are, for the most part, entirely adequate for a book of this scope. A number of the photographs are quite good—particularly the one showing about two dozen *Triturus torosus* typically aggregated into a big heap in an aquarium. The key appears to be very thoughtfully constructed. It is dichotomous, with considerable information given at each choice. The addition of a Glossary is something that other semi-popular books might do well to emulate.

Most disappointing were the chapters on the life habits of the amphibians and reptiles. These chapters contain nothing particularly novel in the way of either information or presentation—but perhaps this is to be expected in a book of this type. One would have hoped for an original synthesis of the data, with an evaluation, perhaps, in terms of phylogeny. Such contributions to a general biology of these groups, particularly of the reptiles, still awaits doing.

Minor errors have crept into the book. It is inferred that in evolution amphibians gave rise to reptiles, reptiles to birds, and birds to mammals (p. 3). It is stated that the coloration of *Hyla regilla* may be brown or green, depending on the environment (p. 18), whereas it is probable, to a large extent, that other factors are involved. Pickwell has placed the turtles in the Synapsida instead of the Anapsida. In this he follows the *Check List of North American Amphibians and Reptiles* but has ignored the sound work of men like Zittel, Osborn, Williston, Case, and Romer. The eardrum is considered to be concealed in the Caudata, whereas actually it is entirely absent. Dermal glands are mentioned, where epidermal glands are meant (p. 78). The maxilla is referred to as a synonym for the upper jaw, a usage not strictly correct, since other bones are also involved. A few other definitions in the glossary could be improved. For example, distal is described as "remote from the point of attachment or origin." The Bibliography has a few surprising omissions: Camp's *Key to the Lizards*; Blanchard's *Diadophis Monograph*; and Smith's *Handbook of Lizards*. (Perhaps the last item appeared while the present book was in press.) The style of the text is rather uneven. Contrast, for example, the rather technical passage, "The hemipenes, which are paired diverticula of the cloaca, lie in the caudal portion of the body of the male," with the quite popular style of the following: "Perhaps nature provided the Toad with many eggs so that many could be sacrificed to the whims of sun and puddles and yet there would be enough to survive in other puddles to keep our West Coast always supplied with dooryard toads." Frog, Snake, Lizard, etc., are regularly capitalized. The paragraph on the collecting of rattlesnakes is certainly too cavalier for all but experienced collectors who, quite obviously, would derive little new information from it. Dust shot, as a collecting method, is not mentioned, nor are museums or scientific collections given any space. In a paragraph on the special senses of reptiles only the eye, ear, and tongue are mentioned; among the omitted are the interesting Jacobson's Organ and the pit organ of the Crotalidae. A reader might pick up a number of misconceptions about good taxonomic procedure. The three races of *Batrachoceps pacificus* are separated in the key solely on geographic grounds. It is suggested that the forms *croceater* and *sierrae*, in the genus *Ensatina*, may intergrade; yet they are given full specific rank without further discussion. The name, *cinereous*, is placed in parenthesis after *Crotalus atrox*; these names are involved in a nomenclatorial tangle, and this method of linking them is undesirable. The book is not free of typographical errors.

All in all, this is a good book for an amateur audience. It is an attractive, interesting, and informative manual. The author, well-known for his series of pictorial books on weather, deserts, etc., marks with this book his entry into a new field. The book has much textual material and is not designed to be carried by the photographs alone, and Pickwell has had the help of outstanding authorities. If the loose ends could be brought together, this would be a volume that could be heartily recommended to amateur and professional naturalists of the West Coast alike.

ARNOLD B. GROBMAN

REPTILES AND AMPHIBIANS OF THE NORTHEASTERN STATES. *A Non-Technical Résumé of the Snakes, Lizards, Turtles, Frogs, Toads, and Salamanders of the Area.*

By Roger Conant. Zoological Society of Philadelphia, Philadelphia. $1.00 (paper). 41 pp.; ill. 1947.

This is a well done non-technical review of the amphibians and reptiles of the northeastern states, defined to include New England, New Jersey, and Delaware, and those parts of New York, Pennsylvania, and Maryland that lie east of a line passing through Harrisburg and Corning.

There is a general introduction and a check list of the forms (27 kinds of snakes, 6 lizards, 16 turtles, 20 anurans, and 18 salamanders), giving their common names, scientific names, and distributions. Next is a summary of information about snakes, followed by a description and photograph of each form known from the area. The same treatment is extended to the lizards, the turtles, the frogs and toads, and the salamanders. Included under their respective groups is a special consideration of venomous snakes (and snakebite treatment) and of baby turtles. The pamphlet concludes with an account of the care of captive specimens, a list of 25 pertinent references, and an index.

Those familiar with the Philadelphia Zoological Garden's journal, *Fauna*, will find that this article is largely a compilation of material that has already appeared there as separate papers. It is nice to have a single issue of it, for it is accurately written, up to date, and ideal for amateurs. The photographs are, almost without exception, excellent. The textual material is well handled; Conant is unusually proficient in presenting animals to the public.

Slips are rare. It is inferred that cloaca and rectum are synonymous terms (p. 25). It is also stated that eyelids are lacking in snakes (p. 12), whereas the eyelids are actually transparent and fused over the eye, giving merely the illusion of absence.

ARNOLD B. GROBMAN

THE ILLUSTRATED ENCYCLOPEDIA OF AMERICAN BIRDS, *Including Key for the Rapid Identification of Birds.*

By Leon Augustus Hausman; illustrated by Jacob Bates Abbott. Garden City Publishing Company, Garden City, New York. $2.49. lxvi + 541 pp. + 16 plates; text ill. 1947.

According to the manner in which an individual defines or interprets the word "encyclopedia" will depend in large part his major criticism of this book. If a comprehensive survey of knowledge about North American birds is understood, then the reader will be disappointed; if merely a dictionary of facts, then perhaps he will be less so. "Gazetteer" would have been more appropriate than "encyclopedia." The text is essentially an alphabetically annotated list of North American species and subspecies of birds, as recognized in the fourth edition of the A. O. U. Check-List. A description of male and female plumage and of the size and distribution of each form is provided. For each species as a whole there are additional remarks on food habits, noticeable behavior characteristics, preferred habitats and other miscellaneous information. Since the alphabetical ordering has been done on the basis of common names, related species are together only if they happen to have similar common names. Members of the same family may be widely separated (e.g., chickadee, titmouse), and even closely related species (greater scaup duck separated from the lesser scaup by the Labrador duck) or subspecies (Eastern golden-crowned kinglet from the Western by the Eastern ruby-crowned) may not follow one another. Some reprints of Fuertes' earlier paintings and numerous, rather likeable, pen-and-ink drawings illustrate the species. There is appended a list of North American birds taken from the official Check-List, and an index to other popular names, an index of scientific names of families, a list of state birds, and a bibliography of sorts.

HENRI C. SEIBERT

A PRELIMINARY LIST OF BIRDS OF MARYLAND AND THE DISTRICT OF COLUMBIA.

Compiled and annotated by Irving E. Hampe and Haven Kolb. The Natural History Society of Maryland, Baltimore. $1.00 (paper). xii + 80 pp. + 1 plate + 1 map; text ill. 1947.

The present list contains 338 accepted forms and 27 hypothetical ones that have been recorded within the political confines of Maryland and the District of Columbia. For the most part the authors have not included in their list any forms unsubstantiated by specimens. Some sight records have been admitted if the bird was seen by at least two competent observers on more than one occasion. In several cases this has resulted in the exclusion of a few records of undoubted authenticity, but as is rightly pointed out, it is easier to add to such a list than to subtract from it once the information has appeared in print. Because its varied topography provides widely contrasting ecological conditions, the state has been divided into five major sections to facilitate discussion of distribution. These are: the Eastern Shore; southern Maryland; the Baltimore-Washington area; Central Maryland; Western Maryland. The seasonal status and distribution with regard to these five areas is given for each species and subspecies. One of the most valuable features of this book is the candor with which the authors admit a lack of information on the bird life in the state as a whole, and whenever such data is lacking, the fact is clearly pointed out. Budding students, dreaming of far away explorations, may well take heed of the inadequacy of our information concerning such a popular field as bird study even within such a densely populated area as Maryland. This useful booklet is further enhanced by a list of references, an index, and a map. The printing

of place names in the latter is unfortunately not up to the standards set by the rest of the book.

HENRI C. SEIBERT

OISEAUX DE LA RÉUNION. *Faune de L'Empire Français, IV.*

By Jacques Berlioz. Librairie Larose, Paris. 250 fr. (paper). iv + 83 pp.; ill. 1946.

Although Reunion, the westernmost of the Mascarene group of islands, was not apparently inhabited until the beginning of the 17th century, its bird life has undergone a tremendous change. Many species have become extinct since the time when DuBois visited the islands and gave an irritatingly brief account of the birds that he observed. Many more have been introduced, and as a result it is now difficult to analyse and evaluate the bird fauna. However, it seems that Reunion's bird life has always been scant, as it is on Mauritius, Rodriguez, and Madagascar, and consists mostly of primitive types of birds. Most of the perching birds are recent introductions. Of special interest is the solitaire, known only from written descriptions and some paintings presumably copied from a living model. Migratory species form a third category of birds present on the island, one which will probably increase in number as more specimens are collected. This report lists all of these birds and discusses their status on Reunion as well as neighboring islands. An introduction gives the historical background of the island, especially its former bird life, and its zoogeographic affinities.

HENRI C. SEIBERT

BIRDS OF MALAYSIA. *The Pacific World Series.*

By Jean Delacour, with line drawings by Earl L. Poole and Alexander Seidel. The Macmillan Company, New York. $5.00. xviii + 382 pp.; ill. 1947.

With the appearance of the present volume, the trilogy of handbooks on the birds of the South Seas, Philippines, and Malaysia is completed. The area encompassed in the term Malaysia includes the Malay States as far north as the isthmus of Kra, Sumatra, Java, Bali, Borneo, Palawan, and neighboring islands. The plan followed in this book is essentially that used in the *Birds of the Philippines*, a cooperative effort of the present author and Ernst Mayr. The introduction contains very brief remarks on the history of ornithology in this region. Since so little is known about the life histories of Malaysian birds, the hints to observers that appeared in the first volume of the series are reprinted here. The Malaysian subregion and its four zoogeographic provinces are briefly described.

For nearly all families field keys to the species have been provided. The species themselves are described in some detail, as to size, plumage coloration (of both se in dimorphic forms), and range. The distribution subspecies is indicated. Here and there succinct not on the habits of the better known birds are interpolate but such information is meager. Migrant shore bir are only listed, and the reader is referred to Mayr volume for further details. Some 84 line drawings b Earl Poole and Alexander Seidel illustrate many specie and for the most part they are well executed. Addi tional drawings would not have been amiss.

Like the other books of this series, the materia gathered here is not only useful as a field guide, but als as a resumé of the variety and the distribution of th bird life in a region unfamiliar to most of us. Both o these tasks have been excellently performed. In addi tion to an index, there is a list of generic synonyms t facilitate reference between the generic names used i this volume and those used by Chasen in his *Handlist o Malaysian Birds*. The inside cover and fly leaf has a map of Malaysia for ready reference.

HENRI C. SEIBERT

FIELD GUIDE TO BIRDS OF THE WEST INDIES: *A Guide to All the Species of Birds Known from the Greater Antilles, Lesser Antilles and Bahama Islands.*

By James Bond, illustrated by Earl Poole. The Macmillan Company, New York. $3.75. xii + 257 pp + 1 plate; text ill. 1947.

Now that North America is well supplied with fiel guides on birds, the tendency is to spread out to foreig lands. The present manual includes the avifauna foun on the Bahamas, the Greater Antilles as far south a west as Swan Island, and the Lesser Antilles to Grenada The islands lying close to the South American continent —Tobago, Trinidad, Curacao, etc.—are excluded, sinc their bird life is essentially continental. The writer, a well-known authority on birds from this area, states that he has included all the species known to inhabit or to occur within the aforementioned area. All of these species (subspecies are virtually ignored) are briefly described, in many cases with the addition of differentiating and diagnostic features. The latter information is of especial importance to the beginning student. In view of the fact that the field work in this area is hardly comparable to what has been done in North America, it will require much further experience to evaluate the reliability of these characteristics. In many instances it is assumed that the student is already familiar with North American birds, as comparisons are frequently made among birds that are more or less similar in both areas. There are useful hints on how and where to look for birds in the West Indies. For the more remote areas, a guide is recommended, and in order to facilitate the communication of ideas between the explorer and his guide, the local names of each species as well as its

gs and notes are provided. The book is indexed, ssesses a map on the covers, and is liberally illustrated ith line drawings by Earl Poole. All visitors to these lands, whether remotely or avidly interested in birds, ill need this guide as part of their travelling equipment.

HENRI C. SEIBERT

CATALOGUE OF CANADIAN RECENT MAMMALS. *National Museum of Canada, Bulletin Number 102, Biological Series Number 31.*

By Rudolph Martin Anderson. Department of Mines and Resources, Mines and Geology Branch; Edmond Cloutier, Ottawa. 75 cents (paper). vi + 238 pp.; ill. 1946.

This catalogue is a distributional list of those mammals known to exist now, or to have existed within historic time, in the Dominion of Canada, Newfoundland, Greenland, and the adjacent seas. It is admittedly an incomplete list for this vast area, but it includes everything that has been recorded on good evidence up to date, thus filling a great gap in mammalogical literature that has existed only too long.

Nearly 600 mammalian species and subspecies have been recognized as indigenous in the territories considered, whereas in 1820 Desmarest could describe only 00 species inhabiting all of North America. Of the hirteen orders of mammals occurring in the northern art of the New World, only the Perissodactyla (tapirs), enarthra (sloths, anteaters and armadillos), and enia (seacows) are not represented in Canada, and of e 64 North American families only those limited to ne subtropical bats, rodents, and primates are not cluded in the Canadian list.

In compiling this scholarly catalogue the author has largely followed the improved sequence of orders used by the late Glover M. Allen, and has, e.g., placed the primates after the insectivores, the Cetacea after the pinnipeds, and treated the lagomorphs as a suborder of the order Rodentia. For each species and subspecies reference is made to the first publication of the respective name, and the most common synonyms are given, as well as type localities and the range, according to present knowledge.

As a basis for future and more detailed reports this monograph is of outstanding value. There are unusually few and very minor printers' errors, but there is only one illustration, showing (with too great reduction) the life zones of North America. More maps of distribution would have been very helpful.

A. H. SCHULTZ

WILD MAMMALS OF VIRGINIA.

By Charles O. Handley, Jr., and Clyde P. Patton. Commonwealth of Virginia, Commission of Game and Inland Fisheries, Richmond. $3.00. viii + 220 pp. + 1 plate; text ill. 1947.

This small but serviceable account of Virginia mammals has been written chiefly for the layman. There are simple and reliable keys for the identification of species, numerous maps of distribution, based upon as yet incomplete information, and notes, varying somewhat in scope and detail, on the behavior, ecology, etc., of many of the animals listed. The illustrations are mediocre at best, but the text is clear and well organized. It is a pleasure to read that the authors plan to continue their studies on the occurrence and distribution of mammals in Virginia and that there is hope for the restoration of species in depleted areas through improved game management and, it may be added, through much needed state-wide respect for game laws.

A. H. SCHULTZ

ECONOMIC ZOOLOGY

INSECTS AND HUMAN WELFARE. *An Account of the More Important Relations of Insects to the Health of Man, to Agriculture, and to Forestry. Revised Edition.*

By Charles T. Brues. Harvard University Press, Cambridge. $2.50. xiv + 154 pp. 1947.

In this revised edition, the pleasant readable story of the ways in which insects affect the welfare of man has been brought up to date, to include some of the notable advances made in insect control since the First World War. The chapter on insects in relation to public health has been extensively revised and enlarged. Photographs have been eliminated in favor of additional charts. New material has also been added to the sections on Insects and the Food Supply, Forest Insects, and Household Insects. Those who have feared the effects on national health of returned veterans who were exposed to a plethora of tropical diseases will derive solace from the concluding chapter, The Outlook for the Future.

V. G. DETHIER

DDT *and the Insect Problem.*

By James C. Leary, William I. Fishbein, and Lawrence C. Salter. McGraw-Hill Book Company, New York and London. $2.50. viii + 176 pp.; ill. 1946.

This is an interesting discussion of the history and use of DDT. In the introductory portion the authors point out that DDT is an insecticide, and a better one, killing more insects than any other one material has ever accomplished. There are many insects it will not control. It is not necessarily a "miracle insect killer," though it came to light at a time when it seemed miraculous—saving the lives of so many men in service and

helping to win the war. Certain characteristics of DDT are pointed out, such as its residual value, its dual (stomach and contact) insecticidal action, and the minute dosages needed to kill controllable insects. The various forms in which it can be used, its danger to plants, man, and animals, its effects upon injurious and beneficial insects as well as upon the soil, and the relation of these results to the balance of nature are also discussed. A general discussion takes up the whole question of the interrelation of insects, the losses sustained by man, the place of beneficial insects and chemicals as controls, and insect control measures used before DDT was discovered. A considerable amount of space is devoted to the chemical structure and chemistry of DDT, its toxicology to man, the problem of its solubility in fats and oils, and the question of its getting into milk produced by animals which chance to feed upon DDT-sprayed forage. The method of its action as a toxic agent upon insects and cold-blooded and warm-blooded vertebrates is treated in a general way. A rather brief portion deals with the various methods of formulation, the percentages used in sprays and dusts, and how these should be applied to control different insects. A summary is given of the uses of DDT in the war to prevent the transmission of insect-borne diseases following its discovery, the history of which is also briefly outlined. This is followed by a resumé of its use in promoting both the health and comfort of man, including methods of use and application about the house. The latter portion of the book contains a rather full account of the various uses of DDT in agriculture, its value in treating shade trees and ornamentals, and its contribution to the control of important injurious insects in fruit production.

A good bibliography is appended to each chapter. The book is written in an interesting and informative style.

DWIGHT M. DELONG

DDT AND OTHER INSECTICIDES AND REPELLENTS DEVELOPED FOR THE ARMED FORCES. *United States Department of Agriculture Miscellaneous Publication Number 606.*

Prepared by the Orlando, Florida, Laboratory of the Bureau of Entomology and Plant Quarantine. United States Department of Agriculture, Washington, D. C. 20 cents (paper). 71 pp.; ill. 1946.

This bulletin is divided into ten parts, the first of which (Part I) is introductory and covers the summary of the developmental work of the experimentation and use of chemicals for the armed forces. Part II is the discussion of the history, chemical formulae, properties, methods of analysis, formulation and various solvents for the use of DDT, with also a brief discussion of DDT in dust form used with different diluents. Benzene hexachloride is briefly discussed, as well as the main story of repellents and miticides. Part III concerns the use of DDT in the form of larvicides for the control of anopheline and culicine mosquitoes especially. This includes the liquid and dust materials and the methods of formulation and application of oil and aqueous preparations. Part IV treats the use of DDT for the control of adult mosquitoes, mentioning especially the residual effect, equipment, and methods of application to buildings, bed nets, and vegetation. Also the use of DDT in aerosols is treated, as well as the use of concentrated spraying. Part V is concerned with airplane application of DDT. Various types of equipment for dispersion and application of sprays are discussed and illustrated. The types of planes best adapted to this work and special equipment built into the planes to give more satisfactory dispersion of sprays and dusts are described and illustrated. There is also a discussion of the evaluation of the airplane application of DDT sprays. Part VI is a brief but general discussion of the uses of DDT, especially for the control of flies, bedbugs, fleas, roaches, and a few other miscellaneous insects. Part VII supplies the information concerning the control of human lice and scabies, mentioning especially louse powders and their use in the control of body lice, impregnation of clothing, sprays for the control of lice eggs on the hairs of the body, control of head lice, crab lice, and the control of scabies. Part VIII mentions briefly the work done upon the development and use of insect repellents, pointing out especially the formulae used for the protection of the armed forces. Among those topics treated are applications of liquids and creams to the skin, the treatment and impregnation of clothing, the conditions under which repellents should be used, and the insects affected by the use of repellents. Part IX deals with protective measures against mites, the conditions under which miticides should be tested, the methods of applying them, impregnation of clothing, and the control of mites in breeding areas. In order to warn against probable dangers and irritations in the use of these materials, Part X considers the toxicity of DDT, together with its solvents, emulsifiers, activators, and other adjuvants, to man.

DWIGHT M. DELONG

DDT: KILLER OF KILLERS.

By O. T. Zimmerman and Irvin Lavine. Industrial Research Service, Dover, New Hampshire. $2.75. xii + 180 pp.; ill. 1946.

The appropriate title of this short book points out the sequence by which the story of DDT is here uncovered, starting with descriptions of various plagues of the past which were intimately related to the insect world and continuing to the birth of DDT, its qualities, and its effects. The seven chapters contained in the book take

up the various phases of vital interest from a historic point of view, as well as the present outlook. In the first chapter there are short descriptions on the importance of such diseases as bubonic plague, typhus, malaria, yellow fever, and Rocky Mountain spotted fever, as well as information about the first discoveries of the vectors of these diseases and subsequent attempts to control them. By this introduction the stage is set, and the great need for an insecticide such as DDT shown. Some 70 years elapsed from the time of the first synthesis of DDT by Othmar Zeidler to the work of Paul Müller in 1934 which again brought to light this most important insecticide. Work during the years of World War II has finally released DDT to the civilian population. The great loss of lives and money due to typhus during previous wars was greatly reduced by the use of DDT. The city of Naples affords an outstanding example of the new typhus control. The cautions to be employed in the use of DDT, its value, the dangers involved (including the exaggerations first propounded), and its specific usage on ants, bedbugs, fleas, flies, lice (human and animal), mosquitoes, moths, and ticks are described. Many experiments determining the toxic dosages for various types of animals are mentioned, and the difference in its toxic effects upon cold-blooded animals, which are very susceptible to DDT poisoning, and in contrast upon warm-blooded animals, which are usually relatively resistant ($\frac{1}{10}$ gr./kilogram being found a general "safety" limit), are pointed out. The various uses of DDT in household and outdoor sprays and dusts, aerosols, emulsions, and paints are described, and the approximate amounts to be used are related. Comparisons are made with other insecticides, many of which have been used for some time as general or specific materials. One fact brought out is that, of the insecticides commonly employed, DDT and sodium fluoride are the only ones to act both as stomach and contact poisons. This factor has been one of the great points in the favor of DDT, because one or the other or both qualities may be found useful in different situations.

The book is written in a light, easily read style, which should appeal to the layman as well as the scientist who wishes to have a handy reference of facts pertaining to DDT. The appendix, in two parts, is a brief summary of the text (Part I) and an agricultural use guide (Part II). Twenty-four photographs are the only illustrations.

DWIGHT M. DELONG

BIBLIOGRAPHY ON AVIATION AND ECONOMIC ENTOMOLOGY. *United States Department of Agriculture Bibliographical Bulletin Number 8.*

Compiled by Ina L. Hawes and Rose Eisenberg. United States Department of Agriculture, Washington, D. C. 35 cents (paper). iv + 186 pp. 1947.

The references selected for inclusion in this extremely useful bibliography are those on the relation of aircraft to the control of crop pests, forest insects, and mosquitoes, to the transportation of disease vectors, together with the attendant problems of quarantine and disinfestation, and to insecticidal injury to bees, livestock, etc.; aircraft studies of aerial fauna; and aerial scouting and mapping of infested areas. The literature cited covers the years 1919 through 1944. This bibliography is a revision and enlargement of the *Bibliography on the Use of Airplanes in Insect Control, 1922–1933*, compiled by W. E. McBath in 1934.

V. G. DETHIER

ANNALES BIOLOGIQUES. *Volume Number II, 1942–1945.*

Edited by H. Blegvad and AA. J. C. Jensen. Conseil Permanent International pour l'Exploration de la Mer, Charlottenlund Slot, Denmark; Andr. Fred. Høst & Fils, Copenhage. Kr. 12.00 (paper). 174 pp. + 1 chart; text ill. 1947.

The second volume of this new series is devoted to analyses of the fish populations and hydrography of the North Sea, Atlantic slope, and Baltic areas for the years 1942–45. There is also information on the deep-sea prawn.

FISH PONDS *for the Farm.*

By Frank C. Edminster. Charles Scribner's Sons, New York and London. $3.50. xiv + 114 pp.; ill. 1947.

This book is written in a style that is not only easy to understand, but is entertaining as well. Part of this effect is achieved by keeping the chapters relatively short and yet to the point. In addition, the author is not afraid to point out difficulties or to suggest where the amateur fish culturalist will need the aid of expert help. This leaves the reader with the feeling that he can confidently proceed to establish a fish pond; for it is made clear that specialized advice is not essential to most of the project and can be easily obtained from well-defined governmental sources.

The format and illustration of the book are also excellent. There can be little doubt that it will be of great practical value to anyone who wants to create a highly productive fishing pond.

JOHN E. CUSHING

POULTRY HANDBOOK. *An Encyclopedia for Good Management of All Poultry Breeds.*

Edited by Rudolph Seiden. D. Van Nostrand Company, New York. $6.00. xviii + 410 pp.; ill. 1947.

This handbook is a first encyclopedia on poultry. The information is drawn from a limited list of authentic sources, sometimes but not always from the most recent and authentic. Pronunciation and definition are given for less usual terms. Feed and other service personnel, vocational teachers and extension workers, and poultrymen will find this a useful book. The book is intentionally weighted with material on the control of diseases and parasites.

T. C. BYERLY

DOMESTIC GEESE AND DUCKS: *A Complete and Authentic Handbook and Guide for Breeders, Growers and Admirers of Domestic Geese and Ducks.*

By Paul Ives; illustrated by Franklane L. Sewell, Arthur O. Schilling, and others. Orange Judd Publishing Company, New York. $3.50. xii + 372 pp.; ill. 1947.

This book was written "for breeders, growers and admirers of domestic geese and ducks." It is an unusually readable description of the breeds and varieties, their history, their husbandry, and their preparation for the table. The account is unfettered by rules of pedagogy, scientific method, or evidence of zoological nomenclature. The illustrations include some nice pictures by Arthur O. Schilling and Franklane L. Sewell, as well as some ancient, poorly reproduced photographs from the U. S. Department of Agriculture. The author is president of the American Waterfowl Association; he knows a lot about geese and ducks. His point of view is that of a fancier and an enthusiast. The text is embellished with many literary quotations from sources ranging from McGuffey's *Reader* to Edna St. Vincent Millay. Perhaps the most appropriate to this review is one from Dickens' *The Cricket on the Hearth*—"Every man thinks his own geese are swans."

T. C. BYERLY

LA PATHOLOGIE DES OISEAUX. *Two Volumes.*

By G. Lesbouyries. Vigot Frères, Paris. 2000 fr. I, pp. 1–479; II, pp. 480–868; ill. 1941.

This handsome two-volume report on diseases in birds has its subject matter divided into two sections. The first, Les Maladies, describes the conditions resulting from avitaminosis, faulty metabolism of organic and inorganic foods, osseous dystrophies, incubation abnormalities, and tumors. Also in this category are the infectious diseases caused by viruses, bacteria, animal and plant parasites, as well as poisoning from organic and inorganic sources. The second part, Les Affections, includes diseases of a more local nature. These are taken up according to organ systems. First come the affections of the digestive tract, starting with the mouth and proceeding to the esophagus, crop, gizzard, etc. Then come diseases of the liver, pancreas, spleen, urinary system, genital system, the peritoneum, respiratory system, circulatory system, and finally involvements of the sensory, muscular, and cutaneous tissues. The first category goes well into the second volume and consists of 612 pages; the second category takes up the remainder of the second volume. Not all the topics are treated alike, and it is therefore impossible to make any general statement covering the mass of information packed onto each page. As one example, in the chapter on gram-positive bacteria, the sub-chapter on *Streptococcus* includes an historical resumé of the literature, notes on the classification, identification, and culture of diverse avian streptococci, clinical studies (differentiated into symptomatology, pathological anatomy, prognosis, and diagnosis), etiology (methods of infection, resistance, pathogenesis, etc.), treatment and prophylaxis. Plates provide further details of gross and histo-pathology.

From such general statements it should be apparent that this is a work of major importance. Except for one, the following criticisms are mostly picayune. The title is slightly misleading, since the subject matter is mostly devoted to the chicken and to a lesser extent to ducks, turkeys, and other domestic birds. Only rarely are wild birds mentioned. In some places citations have an eye-catching number of misspelled names (Adamson for Adamstone; Klambach for Kalmbach; Mayer for Meyer, etc.). But the major fault, indeed an unfortunate one, is the omission of a bibliography in spite of the hundreds of citations in the text. The excuse given is that a bibliography should be complete, which it seldom is, and that in a book which refers to all the illnesses of several species of animals, the size and importance of such a bibliography would submerge the text. The reviewer does not subscribe to this thesis and feels that this splendid work loses considerable value thereby.

All veterinarians and husbandrymen concerned with domestic fowls will nevertheless find occasion to refer to this publication, and its author is to be congratulated upon a significant achievement, especially in view of a short statement made at the end of the introduction: "Notre reconnaissance vis-à-vis de nos éditeurs est d'autant plus vive que notre traité devait paraître en 1940 et qu'il fut totalement détruit par action de guerre alors qu'il était à l'impression. Malgré la lourde perte soubie, MM. Vigot Frères nous ont demandé de reprendre notre travail avec les notes et les figures que nous avions pu conserver. Oubliant l'amertume du destin, nous avons associé nos courages et nos espérances pour présenter à nos lecteurs la *Pathologie des Oiseaux*."

HENRI C. SEIBERT

THE RELATION OF DISEASES IN THE LOWER ANIMALS TO HUMAN WELFARE. *Annals of The New York Academy of Sciences, Volume XLVIII, Article 6.*

By William A. Hagan, Herald R. Cox, William H. Feldman, I. Forest Huddleson, Harald N. Johnson, Raymond A. Kelser, Joseph V. Klauder, Karl F. Meyer, C. D. Stein, and Willard H. Wright. The New York Academy of Sciences, New York. $2.50 (paper). Pp. 351–576 + 11 plates. 1947.

This series of papers does not include all the diseases that man is capable of contracting from other animals, but the most important ones are represented. Rabies, equine encephalomyelitis, psittacosis and ornithosis, brucellosis, plague, tuberculosis, anthrax, animal parasites, and a bacterium called *Erysipelothrix rhusiopathiae* are the subjects of the separate papers. Since each of these diseases is reviewed by an experienced investigator in the field, the net result is a competent, condensed, and up to date resumé of the economic losses, dangers to man, and the progress in control and eradication. To those not intimately associated with this field of endeavor, it may be an eye-opener to discover the high incidence of diseases that can be carried over to man prevalent among animals with which man has close contact. Biologists in other branches of the science can pleasantly brush up on one phase of their college parasitology and bacteriology by going through this highly readable publication.

HENRI C. SEIBERT

MANUEL DU PIÉGEUR: *Moins de Nuisibles, Plus de Gibier. Second Edition.*

By André Chaigneau, with preface by V. Mairesse. Payot, Paris. 100 fr. (paper). 230 pp.; ill. 1943.

Anyone concerned with the elimination of vermin, for whatever reason, will find in this manual descriptions of a host of methods for doing so. Shooting, poisoning, gassing, and trapping are described, the former and latter being the recommended methods. Each is elaborated in great detail, with information on the best instruments to use, where to use them, when, and how. For instance, the section on trapping is divided into technique and tactics. The former describes steel, box, and homemade traps; the latter includes choice of traps, the qualities of a good trapper, and how to take advantage of the habits of animals. Over 100 different traps are described, and each kind is criticised as to its usefulness, applicability, and other features. In all, the manual is replete with information. Sketches made by the writer illustrate many models, positions, and tricks useful in the trade. Although for the most part helpful, a few sketches are not very clear and were incomprehensible to the reviewer (who is no trapper). The section on poisons does not mention any of the more recent products.

This manual would receive complete approval for its wealth of data and undoubted usefulness, were it not for its attitude perhaps best expressed in the subtitle—"moins de nuisibles, plus de gibier." The idea that by eliminating skunks, foxes, weasels, badgers (European), hedgehogs, birds of prey, jays, crows, etc., game will benefit is one that is rapidly losing ground and is based more on tradition than on facts. However, should some occasion arise when these animals need to be removed, there is plenty of information here as to how to do it.

HENRI C. SEIBERT

BRITISH DAIRYING.

By Frank H. Garner. Longmans, Green and Company, London, New York, and Toronto. 21s; $5.50. 263 pp. + 39 plates. 1946.

This book presents the story of milk production and dairy farming in the British Isles. It "has been written to assist farmers today and in the future to meet the public demand." A brief but informative history relating to the industry is told. Throughout the ages man has consumed milk or dairy products, and without doubt the demand for these products played a large part in the domestication of animals. The biggest development in the liquid milk trade came after 1850 with the developments facilitating transportation. Other changes credited with influencing developments in milk production include improved handling of milk at farms, the demand for cleaner milk which began after World War I, the development of the science of dairy bacteriology, the sale of graded milk, the increased emphasis given to health of cows, the introduction of the panel scheme for dairy cows, and the sale of milk in bottles. Likewise, changes have occurred in butter production. After 1850 the nature of the butter industry changed from a chore performed by the farmer's wife and daughters to the manufacture of butter in factories. These changes were facilitated by the invention of the centrifugal separator, use of the Babcock test, and developments in dairy chemistry. Cheese-making, too, has moved from the farm to the factory—but only recently.

Improvements in breeding and feeding practices are discussed briefly—including licensing of bulls, proven sires, and Registry of Merit requirements. The various breeds of dairy cattle are discussed as to characteristics and qualities. Illustrations throughout the book are good.

Feeding stuffs used in the British Isles are catalogued and their use is elaborated. Diseases and pests of dairy cattle are discussed in a style for the farmer. Practices for raising calves, for handling stock in the store period, and for management of cows in production are given. Brief space is given to costs and returns. The author concludes with a discussion of systems of dairy farming

and advice to the beginner. An adequate index is supplied.

W. A. CRAFT

THE BREEDING OF FARM ANIMALS.

By Chapman Pincher. Penguin Books, Harmondsworth, Middlesex, England, and New York. 1s. (paper). 149 pp. + 4 plates; text ill. 1946.

This small booklet, written in a lively style and in somewhat of a journalistic and crusading attitude, is intended to explain Mendelism and the physiology of reproduction, with especial reference to farm animals. For those already moderately informed in this field it is a bit superficial and superfluous. Mistakes are fairly frequent; but most of these concern details rather than important general principles. Examples are the implications regarding the practical importance of linkage (p. 18, etc.), the almost complete acceptance of the electrolytic separation of male-producing and female-producing sperms as a fact (p. 71), remarks about the frequency of functional hermaphroditism in poultry (p. 83), and the extreme emphasis on the unsuitability of breed crosses for further breeding use (p. 112).

Probably nowhere else can the city-reared get so much information in this field for as little as a shilling. If its lively and interesting style inspires readers to learn more about the subject from more accurate sources, its net effect will be good. If its readers stop with this they will have been entertained and the city-reared among them will have been enlightened and slightly confused about some of the details but they will only have started to learn about animal breeding.

J. L. LUSH

THE BULL TERRIER: *A Comprehensive Treatise on the History, Management, Breeding, Training, Care, Showing and Judging.*

By E. S. Montgomery. Orange Judd Publishing Company, New York. $3.50. 415 pp.; ill. 1946.

This is a readable exposition on dogs in general, and the Bull Terrier in particular. Many historical details about the breed are given. Dog-lovers should enjoy it. The author, a physician, presents his story with enthusiasm. In his own words, "This book records facts about the Bull Terrier which the author has collected over a period of twenty years. It includes many methods employed by the author in his breeding kennels, also information gathered from conversation with breeders, judges, and exhibitors, as well as experiences gained from dogs of all breeds—but especially from Bull Terriers."

W. A. CRAFT

BREEDING THOROUGHBREDS.

By Colonel John F. Wall. Charles Scribner's Sons, New York and London. $3.75. xx + 180 pp. + 1 chart; ill. 1946.

Colonel Wall writes as one who loves Thoroughbreds. This book contains much information regarding pedigrees, families, and noted animals. It contains also information of historical interest in respect to the Thoroughbred horse. Sections relating to the science of breeding are brief but presented in a manner to aid the novice.

W. A. CRAFT

ANIMAL MORPHOLOGY

TRATTATO DI ISTOLOGIA. *Third Edition.*

By Giuseppe Levi. Unione Tipografico-Editrice Torinese, Torino, Italy. Lire 3600 (paper). xvi + 1132 pp.; ill. 1946.

The third edition of Levi's *Trattato di Istologia*, prepared and issued under what must have been extremely trying conditions, is a splendid monument to the scholarship and diligence of its author, as well as to the determination and skill of the Tipographia Sociale Torinese. Several sections of the book have been considerably revised and amplified beyond their scope in previous editions—notably the section on chromosome cytology. In these days when our own textbooks of this much-maltreated subject seem to be contracting, edition by edition, to dry unsupported statements and meagre outlines of just as much as a rather lazy student might be expected to retain after exposure to a semester course, it is a pleasure to hold in one's hands a treatise composed in the leisurely manner, with adequate discussion of sources, and illustrated more than generously with handsome figures, many of them original.

Even so large a work must have its viewpoint and its limitations. The book is directed to the medical student, and the emphasis naturally is on human and mammalian material. Much is cited from other animal and plant forms, by way of illustrating principles; but no attempt has been made to carry through a systematic comparative approach. On the other hand, mammalian Histology, as viewed by Giuseppe Levi, is not Microscopic Anatomy. The student will find that the first major section of the book (Second Part: ca. 200 pp.) is devoted to pure Cytology—that is, to cell structure as related to cellular biology; and that only in the Third Part are tissues discussed. These are not at all considered in relation to the architecture of organs, but are abstracted, analytically, from their situation in the body. A completely logical order of presentation is in such a case out of the question. Levi compromises by using a plan partly developmental: e.g., epithelia and epithelial derivatives; partly functional: tissues with mechanical function, trophic tissues, etc. It is inevit-

able that predilection in the choice of material, due to the author's own researches, should likewise predominate in his treatise: nervous tissue (including supporting elements) occupies some 200 pages in this section.

Revised during the war years, and long delayed in printing, the book quite understandably lacks much of the wartime and post-wartime work. What is surprising is that so much current material really has been included, even though much of it is in the form of added paragraphs or appended notes. The last few years have seen striking advances in our understanding of the biochemical mechanisms of certain of the structures and tissues dealt with; perhaps in these cases a radically new orientation would be desirable. Pervaded as we are at the moment by the new histochemistry (much of it not so very new) and cellular biochemistry, it is, however, well to reflect that considerable time must elapse before any coherent body of cell and tissue chemistry can adequately replace classical histology in scope and in biological applicability. Levi does us a great service in reminding us, in the midst of our excitement over new methods and new results, of the vast heritage of morphological and experimental-morphological information and problems left us by the past hundred years.

To return to the original purpose of the book: the fact of its publication at this time, and its handsome format, combine to reassure us that the new generation of the Italian medical profession will continue to be influenced, in their views on cellular and tissue biology, by a teacher who, in addition to being a scholarly morphologist and a confirmed experimentalist, has consistently enlarged his sources and his outlook beyond national or continental boundaries.

DOROTHEA RUDNICK

MICROSCOPIC ANATOMY OF VERTEBRATES. *Third Edition.*

By James I. Kendall. Lea & Febiger, Philadelphia. $6.00. 354 pp.; ill. 1947.

In the words of the author's preface, this book is designed "to supply a working knowledge of vertebrate microscopic anatomy, based on selected representatives of the various classes, to supplement courses in comparative anatomy and embryology, and to provide a foundation for physiology and graduate work.... It is intended to avoid undue emphasis on human or mammalian material since this field is covered by a number of excellent histological texts prepared especially for medical and graduate students."

As an introduction to classical, fixed-and-stained, low-power histology, this is an adequate text. It is hardly calculated to give the student any real idea of modern trends in histology and of the increasingly important role of histochemical and cytochemical methods. It does not seem that to ask this should be too much, even of an introductory text.

WILLIAM L. STRAUS, JR.

HANDBOOK OF MICROSCOPIC CHARACTERISTICS OF TISSUES AND ORGANS. *Third Edition.*

By Karl A. Stiles, with an introduction by Melvin H. Knisely. The Blakiston Company, Philadelphia and Toronto. $1.75 (paper). x + 214 pp.; ill. 1946; 1948.

This reprinting of the third edition (see Q. R. B. 22: 162. 1947) has admirably corrected the account of mitosis criticized in our review.

STEREOSCOPIC ATLAS OF NEUROANATOMY.

By H. S. Rubinstein and C. L. Davis. Grune & Stratton, New York. $10.00. 19 pp. + 43 plates. 1947.

This atlas comprises 43 plates of stereoscopic photographs, each of which is accompanied by a labelled line sketch, illustrating "those brain structures which have been found useful by the authors in the teaching of neuroanatomy." The spinal cord is not included. The first 5 plates deal with gross embryology, the remaining 38 with the undissected and dissected adult brain. A dissection manual, outlining the procedure followed in the preparation of the plates, is included.

AN ATLAS OF ANATOMY FOR ARTISTS. *First American Edition from the Sixth Revised Edition.*

By Fritz Schider. Revised by M. Auerbach, with contributions by Franz v. Stuck. Translated by Bernard Wolf. Dover Publications, New York. $6.00. xxviii + 116 plates. 1947.

Anatomical atlases for artists have recently appeared in increasing numbers but without real improvement in the all-important selection of information needed by artists. The present volume contains very little text, barely enough to explain the generous supply of illustrations. The latter are accurate and adequately reproduced, but include a good deal that is of no use to artists. For instance, the crude Frontal Sections through the Head and through the Pelvis of a Seven Months Old Foetus, or the distorted Cross-Section through the Abdomen are by themselves of no help or interest to any artist. On the other hand, more than one single and schematic drawing of facial muscles would seem most desirable. The ghastly photographs of Female Anatomy, showing contours and proportions, must have been selected by a misogynist. This book

rises above mediocrity by the inclusion of some splendid drawings of human figures by the late German painter Franz von Stuck.

A. H. SCHULTZ

DAVISON'S MAMMALIAN ANATOMY *with Special Reference to the Cat. Seventh Edition.*

Revised by Frank A. Stromsten. The Blakiston Company, Philadelphia and Toronto. $4.25. xii + 349 pp.; ill. 1947.

Among the special mammalian anatomies, this is one of the best known, and it is widely used in courses in comparative anatomy where the cat is the particular object of dissection. In general, it is a concise, useful book, but at the same time it is possessed of many of those defects common to most textbooks of vertebrate comparative anatomy.

Actually, it is a cat anatomy, with some limited attempts at comparison with other mammals, notably man. The author gives evidence of being aware that the future of comparative anatomy, if it is not to remain moribund, lies in a reorientation to a more physiological viewpoint. Thus he has stressed the adaptational aspect of his subject, which is all to the good, and in this respect the book contrasts markedly with many other current textbooks. It includes a brief comparison of mammalian limb structures from a functional aspect, a short consideration of muscular adaptations, one page devoted to a wholly inadequate account of the functions of the cerebral cortex; and occasional references to physiology are scattered through the text. But the author has not taken full advantage of his opportunity. For example, in the last few decades the nervous system of the cat, and more particularly the brain, has been the object of such extensive and intensive study that a stimulating account of encephalic function could have been included. Until the practitioners of comparative anatomy realize that this branch of science is legitimately comparative *biology*, and not merely descriptive, dead-house morphology, and that comparative physiology should be an integral part of comparative anatomy and not merely window-dressing, their subject will continue to wither on the stem. If comparative anatomy is now virtually passé, as many biologists insist, the fault is that of comparative anatomists themselves and not of the lack of problems worthy of consideration.

It is rather appalling to find so many errors or questionable statements and omissions in a seventh edition. A few, selected at random, follow: Neither the neurilemma nor the node of Ranvier is present in the mammalian central nervous system (p. 23). One may question the implied difference between "muscle tone" and "nervous tone" (p. 96). It is grossly misleading to describe the walls of the pulmonary air sacs as "somewhat like the peritoneum" (p. 242). It is not helpful to the student to present the nervous system as divided into central, peripheral, and autonomic components (p. 259). The term "cerebrum" includes more than the frontal, parietal, occipital, and temporal lobes and, furthermore, it is not "primarily a mammalian structure" (p. 261). There are not "seven" cranial nerves originating from the mammalian medulla (p. 275). Not all spinal nerves possess "two" rami communicantes (pp. 281, 297). The superior cervical ganglion does not give off parasympathetic fibers (pp. 286, 289). The accessory nerve is composed of more than the spinal portion (pp. 289, 291). In discussing sense organs, no mention is made of either muscle spindles or tendon organs (p. 302). The only muscles for which the innervation is given are the extensor muscles of the shank (p. 121). The joints are inadequately treated, receiving scarcely more than two pages of text. Inclusion of the endocrine organs with the vascular system is grossly misleading; and the references to their function would have been better omitted. It may be interesting, but hardly enlightening, to learn that "without thyroid, no thought, no growth, no distinct humanity or animality is possible" (p. 229), that "the adrenal gland (medullary portion) is the gland of masculinity . . . " (p. 230), and that insulin "aids in the conversion of glucose into glycogen . . . " (p. 233).

Many of the titles in the lists of literature are incorrect, not infrequently being paraphrastic; this is hardly calculated to foster respect for bibliographic care in the student. The inclusion of so many figures illustrating the anatomy of mammals other than the cat, rather than figures of feline anatomy, is at least open to question.

WILLIAM L. STRAUS, JR.

SQUINT AND CONVERGENCE: *A Study in Di-ophthalmology.*

By N. A. Stutterheim. H. K. Lewis & Company, London. 15s. viii + 95 pp. + 1 plate; text ill. 1946.

In this interesting book Stutterheim purports to show "squint in a new light." However, when the material in the book is carefully analysed, it is found that the problem of squint has not been presented in a new light at all, but instead old ideas on squint have been presented in a new terminology. In general, the terminology employed obscures rather than clarifies the development of the ideas presented. Because Stutterheim has assigned new meanings to old words, he has introduced unnecessary confusions which make it difficult to follow his thoughts. With this lack of clarity it is doubtful that the book will have much influence on the general current of thought concerning squint. This may be unfortunate, for although the book presents no new ideas, it does summarize many of the reasons that have led to the formation of the so-called neurogenic theory of the etiology of strabismus.

Stutterheim points out that in the higher mammals the two eyes, each perfect sensory organs in themselves, have been united into a single sensory organ by fusion. He states: "It is, I believe, a unique condition in biology that two perfect organs of sense, the right and the left eye, should together become a new—namely, a higher—sense organ of the same modality through the sensory unification of the foveal impressions by kinetic reflex activity." The kinetic reflex activity which produces the sensory unification Stutterheim calls "convergence," whereas most authors use the more general term "fusional movements" of the eyes. The term "convergence" as used by Stutterheim is very restricted. He states that what most authors call convergence is composed of two components: one, a voluntary component which he calls "binocular adduction," and the other, an involuntary, which he calls "convergence." He reemphasizes the idea that squint results when the two separate eyes fail to become integrated into a single functioning unit. He says that "squint is a physiological brain disorder of the integrative action for the bi-foveal eye," and that in squint there "is insufficiency or lack of effective power of involuntary or reflex convergence, which is the basic movement of the bifoveal eye." When the integration of the two eyes fails, confusion and diplopia result and the more primitive force of voluntary adduction is used to place the false image on a peripheral portion of the retina where it can be less easily seen. At a later stage, voluntary adduction is replaced by a tonic reflex to maintain the habitual posture, and still later by anatomical changes in the fascial connections of the muscles.

Stutterheim concludes that the logical therapy for strabismus is to increase the effective power of the involuntary or reflex convergence. He accomplishes this by using a battery of prisms to elicit convergence movements. When the progress becomes stationary after this treatment he uses operations (called "surgical adjustments") to correct those anatomical changes that have resulted from the habitual position of the eyes. Of 97 patients treated with these methods, Stutterheim claims to have obtained "excellent" results in 92, an almost incredible percentage of cures.

W. C. OWENS

THE HUMAN EAR *in Anatomical Transparencies.*

By Stephen L. Polyak, Gladys McHugh, and Delbert K. Judd. Sonotone Corporation, Elmsford, New York; T. H. McKenna, New York. $10.50. viii + 136 pp. + 3 plates + 20 transparencies; text ill. 1946.

Although published under different auspices, this remarkable book is a fitting companion to *The Human Eye in Anatomical Transparencies*, by Kronfeld, Polyak, and McHugh (1945). Like that on the eye, it is founded upon a series of magnificent colored paintings by Gladys McHugh. In all, there are 83 figures, including not only series of transparencies but also numerous separate color plates and black-and-white drawings. These are accompanied by an excellent, detailed text. Each of the two parts of the book—Gross Anatomy of the Auditory Apparatus and of the Organs of Speech, and Structure and Function of the Middle and the Inner Ear—contains a series of transparencies showing, respectively, the whole auditory system in relation to the head (actual size) and the middle and the inner ear (three times actual size). There are keys to the illustrations, an extensive bibliography, and an index. The entire format of the book is of extremely high quality.

The authors are to be congratulated for a truly noteworthy accomplishment.

WILLIAM L. STRAUS, JR.

CRANIAL CAPACITIES, A STUDY IN METHODS. *Fieldiana, Anthropology; Volume 36, Number 3.*

By Wilfrid D. Hambly. Chicago Natural History Museum, Chicago. 75 cents (paper). Pp. 25–75. 1947.

The volume of the brain cavity of the human skull is of great anthropological interest, but its exact determination is a laborious task. Various formulas have been devised for quick, empirical estimation of the cranial capacity, based upon the main cranial diameters. In this study there have been conveniently assembled the averages for cranial capacities in great many series of adult human skulls of different ethnic groups, and directly measured values are contrasted with calculated results. The average capacities of males range from 1256 cc. in Tasmanians to 1488 cc. in some European series. The average capacities of women are anywhere from 7 to 13 per cent smaller than the averages of men of corresponding groups. Generally speaking, the formula of Isserlis ($.0003849 \times BLH + 96 \pm 65/\sqrt{N}$) with some slight amendments yields calculated values which agree most closely with the results of direct determinations.

A. H. SCHULTZ

ANIMAL GROWTH AND DEVELOPMENT

EXPERIMENTAL EMBRYOLOGY IN THE NETHERLANDS, 1940–1945. *Monographs on the Progress of Research in Holland During the War.*

By M. W. Woerdeman and Chr. P. Raven. Elsevier Publishing Company, New York, Amsterdam. $2.50 (paper). xii + 132 pp.; ill. 1946.

This small monograph, the preface to which is dated on V.E. day, describes the work carried out in experimental embryology at the Universities of Amsterdam and Utrecht during the years of German occupation.

It is slight in size, but far otherwise in content and import.

It presents the results of 28 investigations by 17 workers, one of whom, J. Kloos of the University of Utrecht, was shot by the Nazis in January, 1945. The details of these studies cannot be enumerated in a brief review. The investigations, some of which were concerned with morphological, others with chemical aspects of development, dealt with amphibian and chick material, and with the development of *Limnaea stagnalis*. The most noteworthy of the contributions in experimental morphology seem to the reviewer to be the following: Studies on the determination of the polarity of the ectoderm, showing that the polarity of the ciliary beat in the epithelium of the ependyma and the auditory vesicles is determined at a different time than, and independently of, the axes of the vesicle and the neural plate (M. W. Woerdeman); studies on the development of teeth formed of ectoderm of *Triton* and mesoderm of *Amblystoma*, demonstrating that the size of the chimaeric teeth is dependent upon the size of the enamel-organ (M. W. Woerdeman); experimental studies on the development of the pronephros, confirming the fact that the pronephric duct does not grow backwards from the pronephros but develops in situ from the lateral plate (J. H. M. G. Van Deth); studies describing the influences of trivalent arsenic and carcinogenic hydrocarbons on amphibian development (G. Ten Cate); investigation of the comparative inductive powers of medial and lateral parts of the archenteric roof (C. P. Raven and J. Kloos); studies on the development of the pineal organ (J. C. Van de Kamer). In addition, the chemical studies on the amphibian egg begun by Ten Cate at Amsterdam, and the exhaustive study on the egg of *Limnaea stagnalis* undertaken at Utrecht, deserve special mention.

It is not possible to review this book without mentioning the conditions under which the investigations were done. In reporting Ten Cate's results, Woerdeman had, for instance, to state: "Ten Cate started work with great diligence, but the unfavourable times have hindered him very much in his work. All kinds of apparatus, simple glassware, chemicals were soon no more available, and finally work became quite impossible when electric current and the gas supply failed. Still it is possible to make some mention of Ten Cate's work." Pure science is pure science indeed, but what scientist can ever forget that these investigators are not only scientists but also men of honor and courage, and who of us can fail to be moved by the eloquence of Woerdeman's quiet comment concerning his own researches: "They will have to be continued no sooner external circumstances permit and the mental peace required for experimental research will have returned"?

The Editors of the Monograph Series of which this forms a part, in their Foreword, "express their greatest admiration for the publishing house of Elsevier, which took very serious risk in preparing this series in wartime, when all activity on behalf of such international purposes was strictly forbidden." It is relevant to add that the execution and reproduction of the magnificent illustrations, the excellence of the paper and the beauty of the typography far surpass those of our own peacetime productions, and add new lustre to a name ancient and distinguished in publishing fame.

JANE OPPENHEIMER

CORRÉLATIONS HYPOPHYSO-ENDOCRINES CHEZ LE TRITON: *Déterminisme Hormonal des Caractères Sexuels Secondaires. Histophysiologie, Volume IX. Actualités Scientifiques et Industrielles, 987.*

By H. Tuchmann-Duplessis. Hermann et Cie., Paris. 300 fr. (paper). 199 pp. + 7 plates; text ill. 1945.

The amphibians are excellent objects for a study of hormonal correlations. Much work has been done in this field, but few papers contribute such a wealth of histological detail as this monograph. The first part deals with the histology of the pituitary gland in *Triton*. Chromophobe, eosinophile, and basophile cells are distinguished, and a secretory cycle can be detected in each of these cells. The secretory cycle corresponds to seasonal variations in the development of secondary sex characteristics. The second part of the book is a report on the effects of hypophysectomy upon the gonads, thyroid, and adrenal glands. The gonads of both sexes and the adrenals show a rapid response to hypophysectomy. Whereas testes, ovaries, and adrenals show signs of involution within a few days after removal of the pituitary gland, the thyroid is much less affected. The third part of the monograph is concerned with the secondary sex characteristics in relation to the reproductive cycle. Both the appearance in gross and under the microscope are described in detail. The effects of castration and of parenteral administration of testosterone propionate or of gonadotrophic hormones on the secondary sex characteristics of the castrate male *Triton* and on males during the period of sexual inactivity were studied. In the castrate, substitution therapy with testosterone was successful, in so far as the secondary sex characteristics were concerned. Testosterone stimulates the growth of the crest of *Triton* during the resting stage. This has been known for some time. The author apparently has overlooked the paper by Fleischmann and Kann, who were the first to describe this effect (1936). The gonadotrophic preparation from horse's serum proved ineffective both in castrated and normal animals.

The histology and cytology recounted in Tuchmann-Duplessis' work are outstanding. The techniques of fixation and staining are carefully described, and the findings are documented by excellent drawings and microphotographs. The bibliography is extensive, though one of the most important papers in the field,

that of Bresca, though mentioned in the text, has been omitted from the bibliography. The book is warmly recommended to students of comparative endocrinology.

WALTER FLEISCHMANN

GESTATION PERIODS: *A Table and Bibliography. Technical Communication Number 5. Second Edition. Compiled by J. H. Kenneth. Imperial Bureau of Animal Breeding and Genetics, Edinburgh; Imperial Agricultural Bureaux, Penglais, Aberystwyth.* 3s. (paper). 30 pp. 1947.

In this new edition numerous records, including those for 35 additional species, have been inserted, and one hundred references have been added to the bibliography. In the reference list, the authors are arranged in alphabetical order, 442 papers being included. In addition to the numerous species listed, hybrids and domestic breeds are also included wherever information has been available. This is an invaluable reference list for anyone working in the field of mammalian reproduction.

TEXTBOOK OF EMBRYOLOGY. *Fifth Edition. By Harvey Ernest Jordan, and James Ernest Kindred. D. Appleton-Century Company, New York and London.* $7.50. xvi + 613 pp. + 2 charts; ill. 1948.

This new edition has a number of revisions and additions of material which make it an improvement over previous editions. This is particularly true of the chapters on the early development of the human embryo. Unfortunately, as much cannot be said for those sections of the book in which gastrulation, and primitive streak and chorda-mesoderm formation in birds are described. The account given does not represent a forgiveable five- or ten-year lag behind the advance of knowledge, but in certain respects is almost archaic. For example, the theory of concrescence of the lateral halves of the dorsal, blastoporal lip to form the primitive streak—"the heresy of concrescence" as Richard Assheton called it in 1916—continues to be perpetuated in spite of its disproof many years ago. The account of endoderm formation in birds is one which was effectively criticized by Assheton in 1912 and has received no support from any source since that time. The description of mesoderm and notochord formation is likewise erroneous in the light of observations and experiments carried out by embryologists in Germany, France, and this country during the last twenty years. It is indeed unfortunate for the value of the book as a whole that the account of the early developmental processes is such a poor reflection of our present knowledge of these processes.

N. T. SPRATT, JR.

A LABORATORY MANUAL OF COMPARATIVE VERTEBRATE EMBRYOLOGY. *By Allyn J. Waterman. Henry Holt and Company, New York.* $3.50. viii + 248 pp. + 54 plates. 1948.

A wealth of information which promises to be very useful to the beginning student of comparative vertebrate embryology is to be found in this compact laboratory manual. Indeed, so many of the background data are included with each exercise that the book may be more correctly described as a combination textbook-laboratory manual or handbook than simply as a laboratory manual. Tabular, comparative summaries of practical information concerning gestation periods, estrus cycles, reproductive periods, sperm and egg viability, etc., are interspersed throughout the book.

The general plan of treatment of the material of the first nine chapters (i.e., through gastrulation and chorda-mesoderm formation) is comparative. The remainder of the book, which is concerned mainly with the development of body form, histogenesis, and organogenesis, does not follow this plan. These later phases of embryology are described first for the frog, then for the fish, chick, pig, and rabbit. Although the general plan here is not comparative, the author frequently points out comparisons between corresponding stages of the different types. A number of demonstrations are suggested to keep the comparative point of view before the student.

A few minor errors, hardly avoidable in a book covering such a wide field of information, occur in the textual parts. For example, the primitive streak of birds is described as shortening without any backward migration of the node. None of the available experimental evidence supports this view. The author, however, has in general presented the evidence on both sides of the argument over the still unfortunately large number of debatable concepts in comparative embryology. That is commendable.

The illustrations at the back of the book are on the whole very satisfactory, but a few of the photographs are not as clear as one might wish. There is also an unfortunate inversion of the photographs of sections of the 72-hour chick with respect to the comparable sections of the 48-hour chick and 10-mm. pig. These minor points, however, do not detract from the interesting style in which the material is presented nor from the utility of the manual.

N. T. SPRATT, JR.

A WORK-TEXT ON HUMAN EMBRYOLOGY. *By Kenneth M. Richter. University of Oklahoma School of Medicine, Oklahoma City.* $4.50 (paper). 162 pp. + 16 plates. 1945.

This book consists of 178 pages planographed on one side of each page, with the facing page left blank for

notes and drawings. The last sixteen pages consist of plates illustrating human embryos of the University of Oklahoma collection. These are line drawings of serial cross sections and photographs of reconstructions of a 2.1 mm., a 3.6 mm., and a 5 mm. embryo. The last three plates are photographs of reconstructions of a 9 mm., a 13 mm., and a 23 mm. embryo.

Enlarged drawings of sections, or of parts of sections, of these and older embryos are found throughout the book, averaging exactly one figure per page for the 158 pages of the text. The text drawings are unlabeled and have lead-lines to the structures which the students are to study and label. Word descriptions are reduced to a minimum, as may be inferred from the fact that figures and laboratory directions occupy about half of the book. There is a Table of Contents, but no Index.

This book was written for a specific course in human embryology and for a specific collection of sectioned human embryos. The extent to which it will be found useful in other institutions will depend upon the extent to which other professors will wish to modify the laboratory instructions to suit their own needs and their own embryological material.

JAMES A. MILLER

THE ORIGIN AND DIFFERENTIATION OF THE LARVAL HEAD MUSCULATURE OF TRITURUS TOROSUS (RATHKE). *University of California Publications in Zoölogy, Volume 51, Number 3.*

By Arthur G. Rempel. University of California Press, Berkeley and Los Angeles. 50 cents (paper). iv + pp. 87–128; ill. 1943.

AN EXPERIMENTAL STUDY OF THE HISTOLOGICAL AND FUNCTIONAL DIFFERENTIATION OF THE EPITHELIAL HYPOPHYSIS IN HYLA REGILLA. *University of California Publications in Zoölogy, Volume 51, Number 7.*

By Arthur B. Burch. University of California Press, Berkeley and Los Angeles. 50 cents (paper). ii + pp. 185–214; ill. 1946.

PHYSIOLOGY AND PATHOLOGY OF THE NEWBORN. *Bibliography of Material for the Period 1930–1940. Monographs of the Society for Research in Child Development, Volume X, Serial Number 41, Number 2, 1945.*

Compiled by A. N. Antonov. Society for Research in Child Development, National Research Council, Washington, D. C. $2.50 (paper). ix + 217 pp. 1947.

ANIMAL PHYSIOLOGY

HANDBOOK OF PHYSIOLOGY AND BIOCHEMISTRY. *Originally "Kirkes" and later "Halliburton's." Thirty-ninth Edition.*

By R. J. S. McDowall. The Blakiston Company, Philadelphia. $7.00. xii + 898 pp. + 10 plates; text ill. 1946.

The 39th edition of this standard textbook bears a date just 98 years later than that of the first edition, prepared by Wm. S. Kirkes. This fact is enough to show that a consistent effort has been made through the years to keep it up to date. It is, of course, essentially a treatment of human, or mammalian, physiology, having been planned and written as a textbook for medical students. With time it has unavoidably increased in size, particularly since, ten years ago, biochemistry was recognized as an integral portion of its subject matter. In the present edition the space devoted to histology has been drastically curtailed, since it was felt that an adequate presentation of that subject would require an entire book and that in the present connection histology should be limited to a relation of structure to function.

RECENT ADVANCES IN ENDOCRINOLOGY. *Sixth Edition.*

By A. T. Cameron. The Blakiston Company, Philadelphia and Toronto. $6.00. viii + 443 pp. + 3 plates; text ill. 1947.

Although the proper title of this book should be "Recent Advances in Medical (or Clinical) Endocrinology," it will fill a useful place on the biologist's reference shelf. The new edition presents only slight changes. The chief additions are accounts of: The production of artificial iodo-proteins on a commercial scale; the use of thiouracil in treating hyperthyroidism, and the existence of individual differences in its toxic effects; and the successful treatment of a patient with Addison's disease over an 11-year period, with a return to almost complete normality, by means of implants and oral doses of desoxycorticosterone acetate plus weekly injections of cortin. The lists of references placed at the ends of the chapters have been brought up to date.

THE PHYSICAL BACKGROUND OF PERCEPTION. *Being the Waynflete Lectures delivered in the College of St. Mary Magdalen, Oxford, in Hilary term 1946.*

By E. D. Adrian. Oxford University Press, London and New York. $3.25. ix + 95 pp. + 2 plates; text ill. 1947.

Every once in a while, the great scientists of our time should be encouraged to step out of their laboratories and to paint in broad, imaginative strokes the full picture of their endeavors. Such an opportunity arose when E. D. Adrian was invited to present the Waynflete Lectures at Oxford in 1946. His six lectures are the substance of this little book.

"What," asks Adrian, "has the physiologist been able to tell us about the workings of the brain and the mind? How do we perceive things?" His answer is this review of the present state of our knowledge in the fields of nerve and brain physiology. And yet it is

more than a review, because the author also speculates aloud about the meaning of certain puzzling findings in this area. He has taken time to worry aloud, as it were, about some things we don't know. This is not the sort of thing one can ever find in a scientific article.

To the neurologist and nerve physiologist, this book will seem quite elementary. But it should be most stimulating to the biologist who is acquainted with this field only in general terms. It is a delightful little book, well-written, easily comprehensible, and uncluttered with footnotes, references, and other scholarly accouterments. I recommend it highly for an hour's worth of genuine reading pleasure.

A. CHAPANIS

RESEARCHES ON NORMAL AND DEFECTIVE COLOUR VISION.

By W. D. Wright, with a foreword by L. C. Martin. The C. V. Mosby Company, St. Louis. $10.00. xvi + 383 pp. + 1 chart; text ill. 1947.

W. D. Wright needs no introduction to research workers in the field of vision. During the last twenty years, his studies of the luminosity, color mixture, discrimination, and adaptation functions in normal and defective color vision have been characterized by their thoroughness and precision. The results of his researches are, in some cases, the standard data to which other visual scientists continually refer. In short, there is probably no one better qualified to write on the subject of color vision.

This book is essentially a summary and review of the author's work in the field. Although the work of other scientists has not been completely ignored, for the most part this is a complete record of Wright's own investigations. Ordinarily, one might expect such a book to be completely unbalanced. There are, to be sure, some rather obvious deficiencies in it. Spatial and temporal contrast, chromaticity as a function of brightness, color perception, tests of color blindness—all these topics, and many more, receive cursory treatment, if they are mentioned at all. But Wright's interests in the field have been so broad that, in writing about his own work, he has given us the best single text on color vision available at the present time.

The author's style is lucid throughout, despite the difficulty of most of the material. His discussion of color equations, unit trichromatic equations, and chromaticity diagrams, for example, is one of the clearest the reviewer has ever read. The book is, nonetheless, an advanced and highly technical work. It will probably be suitable as a text only for advanced seminars in vision. For the physicist, physiologist, or psychologist interested in color vision, however, it is required reading.

A. CHAPANIS

MATHEMATICAL ANALYSIS OF BINOCULAR VISION.

By Rudolf K. Luneburg. Published for the Dartmouth Eye Institute by Princeton University Press, Princeton. $2.50 (paper). vi + 104 pp.; ill. 1947.

Experiments on visual space perception have occasionally yielded some very puzzling data. Ames, for example, at one time constructed a series of rooms with curved walls and windows. When the curvatures were properly selected, all the rooms appeared to have the same rectangular form. In short, a great variety of different physical stimuli resulted in the same perceptual experience. Still other experiments show that the apparent localization of a surface can be changed perceptually by drawing various geometrical patterns on the surface.

The author's aim in this monograph is "to develop a mathematical theory of visual perception" which can account for phenomena of this sort. It is a limited theory, since it is concerned only with the binocular perception of visual space. In particular, the author has tried to develop mathematically a three-dimensional, geometric representation of the loci of points in physical space which appear to be equidistant in binocular vision.

This is the kind of work which should be read by psychologists, physiologists, and physicists who are concerned with visual phenomena. But it won't be! Even to someone with a more than average amount of mathematical sophistication, this is a pedantic, confusing, and extremely difficult treatise. It is most unfortunate that many scientists have not yet learned that scholarly writing is not necessarily incompatible with clear writing. The author doesn't state for whom he wrote the monograph, but one thing is clear—if the reader is not thoroughly conversant with non-Euclidian geometry and differential equations, he will do well to leave it alone. Meanwhile, we may hope that somebody will one day translate this work for ordinary visual scientists. It can be done, as Hogben has shown.

A. CHAPANIS

ANIMAL NUTRITION

NOT BY BREAD ALONE.

By Vilhjalmur Stefansson. The Macmillan Company, New York. $3.50. xviii + 339 pp. 1946.

This is an interesting, and even at times amusing book, written by an active protagonist for a pure meat diet. Stefansson relates his experiences in the far north, where he lived on meat alone, and his subsequent adventures under observation in Bellevue Hospital while on a one year meat diet to convince the sceptical medical fraternity that men can live on meat alone and remain in optimum health.

A second theme of the book revolves around pemmican as the best known balanced condensed food ration

ever devised by man. Here again the author is active protagonist and attacks especially those entrenched dieticians who during the past war rejected pemmican as completely unfit for use by troops. From Stefansson's presentation of the data, including a lengthy history of the use of pemmican and numerous testimonials as to its virtues, it is difficult to see just how the dietitians could have been right. One suspects, as Stefansson brings out, that many crimes are committed in the name of pemmican. The author shows very nicely that there has been an accidental perversion of the use of pemmican. It was originally a hot weather food, but because it was also suitable to cold weather work and was used by the arctic explorers, it has come to be thought of as a cold weather food only. This is in part tied up to the myth that fatty foods are unsuitable for hot weather consumption. These and many other myths concerning meat for food Stefansson explodes with data gathered from all over the world.

Stefansson is not a physiologist, nor is he in the broadest sense an anthropologist. Perhaps this is an advantage, in a way, for his thinking is little inhibited by the dogma of any discipline. He is an active advocate. His work needs therefore to be read with some reserve. It should nonetheless be read, and it is to the author's credit that it can be read with considerable pleasure.

GEORGE F. CARTER

BIOCHEMISTRY

BIOCHEMISTRY FOR MEDICAL STUDENTS. *Fourth Edition.*

By William Veale Thorpe. The Williams & Wilkins Company, Baltimore. $5.00. viii + 496 pp. + 4 plates; text ill. 1947.

This popular textbook has now appeared in a fourth edition. The major revisions have involved a rewriting of sections on protein structure, coenzymes, flavoproteins, bile pigments, and wartime nutrition. The author has also included a new chapter on the use of isotopes. Nevertheless some relatively archaic material remains. One may cite as an example the statements (p. 115) that "nucleic acids, in fact, are almost certainly composed of four units, called mononucleotides" and "recent experiments suggest that *all* the phosphoric acid groups are doubly esterified with ribose." Most workers in the last few years have shied away from positive statements in these directions, and indeed, some leading English investigators state quite the opposite in regard to the phosphate esterification. Although the author has included a special chapter on tracer methods, he has missed opportunities to indicate how it has affected specific phases of our knowledge of intermediary metabolism. Relations between metabolites, presented as hypotheses still to be tested, have already been established. Thus, (p. 276) "serine might also form glycine." It not only might but it often does (Shemin, 1946). However, this was demonstrated perhaps too late for inclusion in this text. On the other hand, the tracer evidence for phenylalanine as a precursor to tyrosine (Schoenheimer, 1940) is quite old, yet is not mentioned.

The book appears to the writer to be one of the better textbooks available for medical students. Its binding and quality of paper are superior to what has been available in recent years to continental publishers.

MARTIN D. KAMEN

AN INTRODUCTION TO BIOCHEMISTRY. *Third Edition. By William Robert Fearon. Grune & Stratton, New York.* $6.00. x + 569 pp. 1947.

The initial appearance of this admirable volume was welcomed by most teachers of biochemistry bedeviled by the necessity for finding an acceptable textbook as a basis for instruction. Now the third edition has been released. The qualities inherent in the first two editions are retained, while improvements have been introduced in revising practically all the chapters. A new chapter on "tissue chemistry" brings the book into better contact with important phases of modern biochemistry, such as respiratory enzyme action, the chemistry of metabolic cycles (Szent-György, Krebs), and mechanisms of energy exchange. The proliferation of isotopic methods is indicated naturally and has not been introduced either with fanfare or disparagement. However, the opportunity to introduce tracer evidence into the text (e.g., interconversion of specific amino acids) has not been seized in all instances. Here and there a few unhappy remarks will be found, particularly in regard to the later history of muscle biochemistry (p. 340)—e.g., a rather positive statement is made about "an aerobic contraction mechanism independent of the Meyerhof-Parnas cycle" and some tracer work in photosynthetic CO_2 assimilation is quoted incorrectly, assigning a molecular weight of 350 to a photosynthetic intermediate when the original article gave values well over 1000 (p. 343). However, there is little to quarrel with and much to praise.

All textbooks on biochemistry which fail to include its dynamic aspects, presented so well in a recent text by Baldwin, miss much of the spirit of modern biochemistry. A little more of this viewpoint would help the present book by Fearon. However, there are many textbooks which nothing could help. Fearon is to be commended for making available a textbook of such general excellence.

MARTIN D. KAMEN

PRACTICAL CHEMISTRY *for Medical Students. By William Klyne, with a foreword by G. F. Marrian.*

A William Wood Book, The Williams & Wilkins Company, Baltimore. $6.50. xvi + 460 pp. + 1 plate; text ill. 1946.

This textbook is written to provide pre-medical students with a broad, comprehensive training in all phases of chemistry at the elementary level. Most writers would blanch at the ambitious task the writer set himself—to cover the fundamentals of the scientific method, practical laboratory manipulations, general and physical chemistry, inorganic chemistry, and organic chemistry. It is a new experience to find a book which deals with "cause and effect," "evidence," "design of experiments," etc., on pp. 1–5, and with boring and fitting corks on p. 46. It is not surprising that the breadth of the subjects treated leads to some attenuation. Nevertheless, much solid material has been included in this book, particularly with regard to laboratory manipulations and tests, in many instances running far ahead of those found in most elementary textbooks. It seems that the author has been remarkably successful in expounding with clarity so many of the fundamental ideas in chemistry without losing sight of the laboratory.

Most of the material presented should have been covered in the last few years of high school and the first years of undergraduate study at the university. One thinks of pre-medical students as having had more than the equivalent of training represented by this book before entering medical school. However, it is possible that the residuum of chemical knowledge left in medical practitioners a few years out of medical school is not more extensive than may be found within the covers of this book, which appears more an outline than a textbook. The extreme brevity of presentation may result in hardship for many students unless amply supplemented by classroom instruction.

MARTIN D. KAMEN

COLLOID SCIENCE. *A Symposium.*

By E. K. Rideal, A. E. Alexander, D. D. Eley, P. Johnson, F. Eirich, R. F. Tucket, J. H. Schulman, M. P. Peruts, G. S. Adair, G. B. B. M. Sutherland and R. R. Smith. Chemical Publishing Company, Brooklyn. $6.00. x + 208 pp.; ill. 1947.

This small book of 188 pages of text has ten articles by ten different authors. It is based on a post-graduate course given at Cambridge University. Unfortunately, except for two of the papers, each author has contented himself with giving a very bare outline of his subject. A. E. Alexander used 53 pages and F. Eirich 37 pages to discuss their topics, "Surface Chemistry and Colloids" and "The Viscosity of Macro-molecules in Solution," respectively. This leaves 98 pages for the remaining eight papers. The result is a very uneven book, in which two papers are very complete and eight are bare outlines.

This book could be used to get a quick survey of the field of colloid science; it would certainly be unsatisfactory for any other use. The price seems abnormally high, even in these days of the inflated dollar.

I. FANKUCHEN

THE SYSTEMATIC IDENTIFICATION OF ORGANIC COMPOUNDS. *A Laboratory Manual. Third Edition.*

By Ralph L. Shriner and Reynold C. Fuson. John Wiley & Sons, New York; Chapman & Hall, London. $4.00. x + 370 pp.; ill. 1948.

Rearrangement in the presentation of chapters in this new edition enhances the value of a book which has always been useful as a text for students and a reference for laboratory workers. The complete outline of experimental procedure for the identification of organic compounds is now put in its proper place, at the beginning of the text. Each chapter, corresponding to a step in the identification process, then follows in logical order. Within each chapter, the plan followed in earlier editions is retained with few changes. New procedures have been added to Chapter VI, and values in tables throughout the book have been brought up to date. Of especial value is the inclusion in the index of the melting and boiling points of all compounds listed in tables throughout the text.

V. G. DETHIER

NUCLEIC ACID. *Symposia of the Society for Experimental Biology, Number I.*

[*Edited by J. F. Danielli and R. Brown.*] *Cambridge, at the University Press; The Macmillan Company, New York.* $8.50. viii + 290 pp. + 18 plates. 1947.

The early proposal by Levene concerning the tetranucleotide structure of ribo- and desoxyribonucleic acids served to stimulate and revitilize the widespread interest in nucleic acid chemistry. Although geneticists have long since recognized the importance of nucleic acids as constituents of the chromosomes, it was not until Stanley and his group demonstrated the presence of nucleic acid in the tobacco mosaic virus that widespread biological interest in the nucleic acids was revived. Since that time very marked and surprising physiological effects have been obtained with these compounds. The relationship and importance of these compounds in protein synthesis, chromosome structure, pneumococcus transformation, adaptive enzymes, neural function, etc., are now being actively investigated.

The widespread importance of these compounds and the more recent findings and postulations concerning their function is well covered in a series of recent papers presented at a Symposium of the Society for Experimental Biology, held at Cambridge University. In a

series of articles concerned with the chemistry of nucleic acids J. M. Gulland, B. Lythgoe, A. R. Todd, D. O. Jordan, and W. T. Astbury participated. The structure of the nucleic acids, as revealed by chemical and physical methods, and the synthesis of their corresponding nucleotides and nucleosides were discussed extensively. H. M. Kalckar presented in detail his recent findings concerning the role of phosphate in the biological synthesis of purines, and T. Caspersson discussed the relationship between nucleic acid and protein synthesis.

The remaining papers of the Symposium were concerned primarily with the detection, distribution, and function of the nucleic acids and nucleoproteins in biological systems. J. F. Danielli considered the current cytochemical techniques, and P. Dustin, Jr., the vital staining of nucleic acids in cells. J. N. Davidson discussed the distribution and ratios of the two types of nucleic acids in tissues, while M. Stacey covered the present information available on the nucleic acids and nucleoproteins of the bacteria. Two papers were presented which were concerned primarily with nerve cell metabolism and function under varying conditions of activity and regeneration. The first paper was presented by H. Hydén and the second by D. Bodian. Papers concerned with the relationship of nucleic acids and their derivatives to the growth and metabolism of neoplastic tissues were presented by L. D. Parsons, J. M. Gulland, and G. R. Barker, and by R. E. Stowell. Nucleic acids in the cell and embryo were discussed by J. Brachet. Three papers concerned primarily with the nucleic acids and the chromosomes were presented. The Action of Enzymes on Chromosomes, by D. G. Catcheside and B. Holmes, is concerned primarily with the action of thymonuclease. The Function of Deoxyribose-Nucleic Acid in the Cell Nucleus is discussed by E. Stedman and E. Stedman; and C. D. Darlington presents certain observations and speculations concerning the nucleic acids in chromosome organization and behavior. The final paper, by P. C. Koller, deals with the problem of experimental modification of the nucleic acid systems in the cell by treatment with chemical or physical agents.

The present series of papers emphasizes the underlying unity of numerous biological problems, a chemical unity which is now becoming clear through the studies concerned with the nucleic acids and their functions. The symposium volume will be of great value to workers in biological and chemical fields because it serves to bring together the numerous problems related to nucleic acid metabolism.

W. D. McElroy

AN INTRODUCTION TO CHEMISTRY: *A Textbook and Laboratory Manual. With Teacher's Guide.* *By Imo P. Baughman. W. B. Saunders Company, Philadelphia and London.* $3.00. x + 315 pp.; ill. 1947.

This is an extremely abbreviated treatment of the field of chemistry, seemingly prepared for the nursing curriculum. The text is limited to 170 pages, to which are added 29 pages of tabular information as an appendix. The remainder of the book is occupied by laboratory directions and report sheets and by the index. Yet there is one feature of the book that biologists will applaud, and that is the inclusion of organic chemistry and biochemistry in the introductory course. If the entire treatment is skimpy, at least it blazes the way toward a chemistry course that would be truly an introduction to biology.

Bentley Glass

MICROBIOLOGY

MICROBIAL ANTAGONISMS AND ANTIBIOTIC SUBSTANCES. *Second Edition.* *By Selman A. Waksman. The Commonwealth Fund, New York; Geoffrey Cumberlege, Oxford University Press, London.* $4.00. xiv + 415 pp. + 13 plates; text ill. 1947.

The first edition of this book was a thorough survey on microbial antagonism and antibiotic substances. The rapid accumulation of information and expansion of the uses of antibiotics thoroughly justified the new edition. This consists of fourteen chapters, which deal with many phases of the general subject of antibiotic substances and microbial antagonisms. Among the subjects covered is the microbiologic population of soil and water as well as of human and animal wastes. The author deals with relationships among microorganisms and painstakingly describes methods for the isolation and cultivation of antagonistic organisms.

In his discussion of the antagonists, the author takes up antagonists and antibiotic substances derived from three general groups of micro-organisms: namely, those from the Actinomycetes, those from other bacteria, and those from fungi. In addition, he has discussed animal forms as antagonists and the relationship between protozoa and bacteria. In this chapter he has also included a description of the protozoan theory of soil fertility as well as "microbiological equilibrium." In the following chapter the antagonistic relationships between microorganisms, viruses, and other non-specific pathogenic forms are considered.

The author next develops the subject of the chemical nature of antibiotic substances. This portion of the text contains an excellent review of the chemical nature of antibiotics and is complete up to the time of its writing. There follows an excellent discussion on the nature and mechanism of antibiotic action. In this chapter the author not only reviews what is known concerning the mode of action of antibiotics but also

presents data on bacterial adaptation, as well as the use of antibiotic substances in the differentiation of bacteria. Comments on many fundamental problems in microbiology are interjected.

The author then devotes two chapters to the use of antibiotic substances for disease control. One chapter deals with antibiotics as chemotherapeutic agents. This is a review of the more important published material dealing with the clinical uses of antibiotics. It is not a clinical monograph, and it is obvious that the author did not intend it to be one. The other of the two chapters deals with what is known concerning the microbiologic control of plant disease. The volume concludes with a chapter which the author chooses to call The Outlook for the Future. Here again the author calls to the notice of the reader many of the problems which this new field of science has opened. He discusses the problems which concern the microbiologist, the chemist, and the physiologist as well as those interested in the practical application of antibiotics in the control of disease.

This book should be on the "must" list of reading for the teacher, the graduate student, or anyone interested in the general subject of microbiology.

WALLACE E. HERRELL

GERM-FREE LIFE STUDIES. *Lobund Reports; A Publication from the Laboratories of Bacteriology, University of Notre Dame, Number 1.*

Edited by James A. Reyniers. University of Notre Dame, Notre Dame. $1.50 (cloth); $1.00 (paper). viii + 120 pp.; ill. 1946.

This publication contains two papers: Rearing germ-free albino rats, by James A. Reyniers, Philip C. Trexler, and Robert F. Ervin, pp. 1–84; and Germ-free life applied to nutrition studies, by James A. Reyniers, pp. 87–120.

The first paper gives details of the extremely specialized and complicated apparatus and techniques required for obtaining and rearing white rats (or other small animals) in the absence of bacteria. The animals are obtained initially by Caesarian section. Stress is laid on the germ-free diets required. Vitamin C is very desirable for germ-free albino rats, although not absolutely essential. With vitamin C, there is better growth and lower mortality (less than 5%). Without vitamin C, growth is slower and the mortality is about 55 per cent. The nature of the protein supplied is also of great importance. Germ-free rats show no external difference from normal rats, but the lymphatic system is underdeveloped histologically. Also the cecum is enlarged, and there seems to be a disturbance in the fat metabolism, at least on certain diets.

The second paper stresses the nutritional aspects of the germ-free life of rats, guinea pigs, and chickens. In general, germ-free animals do not utilize natural diets well. Complete diets fed to germ-free chickens do not give as good a growth as when fed to normally reared chickens. In the mammals, there is a disturbed fat metabolism and underdevelopment or atrophy of the ovaries. Germ-free chickens show a prolonged clotting time of the blood. Some experiments were also done in which one or more species of bacteria were introduced into the intestinal tracts of the animals. When this was done, an alteration in the diet was usually found to be necessary.

It is impossible to summarize adequately this important publication in a limited space. Those who are interested in the effects produced in warm-blooded animals by the symbiotic presence (of absence) of bacteria in the gastrointestinal tract, should consult the original publication.

WALTER C. TOBIE

TRAVAUX DU LABORATOIRE DE MICROBIOLOGIE *de la Faculté de Pharmacie de Nancy. Fascicule XV.*

By Faculté de Pharmacie de Nancy. Société d'Impressions Typographiques, Nancy. Paper. 96 pp. + 2 plates. 1947.

Fascicule XIV (1945) of this publication, normally an annual, was reviewed in Q. R. B. 21: 203–4, 1946. The present issue contains a portrait and obituary of Ph. Lasseur, who founded the publication in 1928, and whose unfortunate death occurred on January 10, 1946.

Seven original papers by J.-G. Marchal et al., are given, and may be summarized as follows: The reducing power of several dissociated strains of bacteria on ammonium molybdate in a synthetic medium was determined. Data are given on the production of the rose-colored and the fluorescent pigments of *Bacillus roseus fluorescens* under different cultural conditions. Another study briefly gives some conditions affecting the growth of this organism. *Bacillus lactis niger* Gorini showed a distinct antagonistic action against *B. mycoides* on agar plates, but only a very feeble action in liquid media. Limited data are given on allelocatalysis in the development of various species of bacteria. The effects of ultra-violet radiation on various species are reported. Data are also given on the action of *Bacterium tumefaciens* on the growth of the plants *Opuntia vulgaris, O. chaguensis*, and *Pelargonium zonale.*

It is to be regretted that the work presented in several of the papers is quite limited in scope, and does not lead to any very definite or clear-cut conclusions. This may be the result of difficult post-war working conditions encountered by the authors.

WALTER C. TOBIE

TEXTBOOK OF MICROBIOLOGY. *Third Edition, Revised. By Kenneth L. Burdon. The Macmillan Company,*

New York. $3.50. viii + 728 pp. + 1 chart; ill. 1947.

This is a very satisfactory textbook of medical and sanitary microbiology, rather than one of microbiology in the widest sense. Only a limited mention is made of the industrial applications of microorganisms, although there is a good treatment of the fundamental facts and theories of microbiology. Besides pathogenic bacteria, the pathogenic molds, viruses, and organisms of other groups receive adequate treatment. A number of well-chosen references (usually to journal articles) are given at the end of each chapter. These references should be of great value if they can be used to pry students away from exclusive reliance upon textbooks, and to develop willingness to seek for information in primary sources.

The book is written in a style that is simple and direct. The material is generally remarkably sound, and is brought well up to date, as for example in the sections dealing with sulfonamide drugs and antibiotics. In particular, there seem to be few if any of the irritating misconceptions which have been repeatedly disproved by specialists in the various fields involved, but which appear to be almost indestructible, owing to the fact that they are parroted from one textbook to another, achieving a sort of discreditable immortality.

However, a few faults and errors may be noted. The value of carbon tetrachloride for first aid to minor burns (p. 235) may well be doubted. It is not entirely correct to say (p. 241) that streptothricin is an antibiotic of low toxicity. Under tuberculosis, it would seem desirable to make at least passing mention of the use of the avirulent Calmette-Guerin strain (B.C.G.) in prophylaxis and of streptomycin in therapy. Nevertheless, these are but minor points, and as a moderately advanced medical text the work is to be recommended.

WALTER C. TOBIE

A TEXTBOOK OF BACTERIOLOGY. *Fourth Edition.* *By Thurman B. Rice. W. B. Saunders Company, Philadelphia and London.* $6.50. xii + 603 pp.; ill. 1947.

This is a text for medical students, to be used in conjunction with a course of lectures and laboratory exercises. The material presented has been rather solidly established, the idea being that very recent advances can be presented in the lectures, which may be revised from year to year as conceptions change. Relatively little attention is paid to non-medical bacteriology. However, disease-producing microorganisms other than bacteria (viruses, rickettsiae, protozoa, pathogenic fungi, yeasts, and the like) receive very adequate treatment. There are also several excellent chapters on immunology, serology, hypersensitiveness, and related topics. The book is written in an interesting style without any observable sacrifice of accuracy. Besides being a very satisfactory textbook for medical students, it should be valuable for microbiologists who have occasional need for a condensed but authoritative presentation of material outside of their own special fields. One minor but helpful feature is the brief characterization of organisms such as the "Boas-Oppler" and the "Zur Nedden" bacilli, which are occasionally mentioned in the clinical literature, but which are little known to most theoretical bacteriologists.

Even the best of books contains some errors, and the present work is no exception. Thus, on p. 287 it is not quite correct to state that "not one member of the armed forces of the United States and Great Britain in World War II died of tetanus." It is true that tetanus was extremely rare, but nevertheless a few fatal cases did occur even in previously immunized personnel (cf. J. S. K. Boyd, *Lancet* 250: 113–19. 1946). The structural formula for sulfamerazine (p. 559) is incorrect, being the same as that given for sulfadiazine. Furthermore, the oral use of penicillin has been quite firmly established, despite the statement (p. 561) that efforts to make it absorbable by mouth have met with little success. These are minor points, and on the whole the book may be highly recommended.

WALTER C. TOBIE

EXPERIMENTAL AIR-BORNE INFECTION. *Equipment and Methods for the Quantitative Study of Highly Infective Agents; Basic Data on Their Use Obtained with Phenol Red, Serratia marcescens and Bacillus globigii; and Preliminary Experiments on the Stability and Infectivity for Laboratory Animals of Air-Borne Clouds of Brucella suis, Malleomyces mallei, Malleomyces pseudomallei, Pasteurella tularensis, and of Viruses of the Psittacosis Group. Microbiological Monographs, The Society of American Bacteriologists.*

By Theodor Rosebury, with the co-authorship and assistance of the staff of the Laboratories of Camp Detrick, Maryland. The Williams & Wilkins Company, Baltimore. $4.00. xii + 222 pp.; ill. 1947.

This book is the first in a new series of Microbiological Monographs sponsored by the Society of American Bacteriologists. It describes in detail the techniques developed and used in the wartime project on the study of fundamental mechanisms involved in airborne infections. Details of the construction of the buildings and the cloud chamber apparatus are given. The installation was equipped to study highly infective agents under conditions of safety to the operating personnel and others. That these precautions were highly successful is evident from the fact that in six months of operation only one laboratory infection occurred. The infective agents were used in airborne clouds and tested on small laboratory animals in such a manner as to elicit reproducible quantitative data on infection by the inhalation route. The selected bacteria and viruses

were evaluated (1) according to their infectivity for the animals used, and (2) according to their stability after the dispersal by atomization. Finally a combined index of stability and infectivity (or of stability-lethality) was worked out. *P. tularensis* (on mice) and *M. pseudomallei* (on hamsters) proved most infective and lethal, in the order given, but *Br. suis* and psittacosis virus were first and second, respectively, in stability. The combined index puts *Br. suis* and *M. pseudomallei* at the top of the bacterial list.

There is a concise summary at the end of each chapter and a good bibliography and index. Detailed drawings and photographs of the apparatus and its operation add greatly to the text. The wealth of technical detail included will be of interest to anyone studying airborne infections, and the safety measures described ought to be most valuable to any worker handling infective agents under any circumstances. The book is pregnant with possibilities for biological warfare, although that term is scrupulously avoided, even to the extent of avoiding citation of the review of that subject by Rosebury and Kabat.

E. PETRAN

PARASITOLOGY

THE LOUSE: *An Account of the Lice Which Infest Man, Their Medical Importance and Control.*

By Patrick A. Buxton. A William Wood Book, The Williams & Wilkins Company, Baltimore. $3.25. viii + 164 pp.; text ill. 1946.

This second edition of *The Louse* by P. A. Buxton of the London School of Hygiene and Tropical Medicine is a most useful and informative book about the lice affecting man: the head louse (*Pediculus humanus capitis*), the body louse (*Pediculus humanus corporis*), and the crab louse (*Phthirus pubis*). He has given a thorough and critical review of the world literature through 1944. Much Russian work on louse control during World War II has been included and is not available elsewhere to most American workers. Many comments were based on personal experiences with these insects, which he reared on himself during 1917 and "again (not continuously but most of the time) from 1934 to the present date (1944)."

The first three chapters cover general taxonomy and biology; external and internal anatomy, well illustrated by excellent figures; individual and collective biology, much of it based on Buxton's personal researches with these insects in England, Africa, and India. In regard to the species status of the head and body lice, Buxton follows current usage in recognizing only one taxonomic species (*Pediculus humanus*). He disagrees, however, with contemporary entomologists who maintain that the head louse will assume the characteristics of the body louse (larger size, lighter color, etc.) when confined in boxes applied to the skin of the body, and vice versa. In one place he has written that "after many generations of being reared under identical conditions the head and body lice remained distinct in general appearance," and "inasmuch as the differences between them seem greater in biology than in anatomy they should be referred to as biological or physiological races. . .they might be called 'species in the making'."

Chapter IV deals with the Medical Importance of *Pediculus humanus*. Human lice are known to transmit typhus fever in Europe, Africa, China, India, and Central and South America. There is a good account of epidemic and endemic typhus and the possibility of one type of typhus gradually becoming the other. American typhus workers designate the causative agent of endemic typhus as *Rickettsia prowazeki* da Rocha Lima (1916), *Rickettsia typhi* Wolbach and Todd (1920), or *R. prowazeki* var. *mooseri* Monteiro (1931). Buxton rather consistently calls this organism *Rickettsia muricola*, a cognomen which dates from 1932. The author emphasizes that the rickettsiae causing typhus fever are transmitted to man through the louse feces, rather than the insect bite, although "it is not possible to state which of these routes, through broken skin, the eye, or the respiratory tract, is the commonest under natural conditions." In discussing relapsing fever, Buxton states that the "spirochaeta is in the body cavity of the louse from which it can only escape if the insect is torn or crushed." During World War I the "cootie," or body louse, was the vector of trench fever, which apparently has disappeared since 1914–1918.

Chapter V, on The Control of Lice, deals thoroughly with the earlier insecticides and mass delousing programs, the lousicides used at the beginning of World War II, such as the thiocyanates, the American A. L. 63 and MYL, and various insecticides used in Russia's war-wrecked cities. The section on DDT is quite adequate, with a good discussion of the powder and its use in mass delousing programs, clothing impregnation, and the use of a DDT hair emulsion for head lice. There is no account, however, of the use of DDT in the Naples typhus epidemic or of its use in preventing wide-spread dissemination of typhus by delousing DP's and other war refugees, since the book was finished in 1945 before this information was generally available.

Vaccine preparation by the laborious Weigl technique, which involves rectal infection of lice with rickettsiae, is mentioned in the final chapter. No mention is made of vaccines prepared from chick embryos, which were used extensively in the Naples typhus epidemic, or of vaccines used in Mexico made from infected mouse or rabbit lung tissue. The bibliography and index appear to be satisfactory and complete.

The Louse is a valuable contribution to medical entomology and a book which every worker in public health would do well to have in his library.

HARRY D. PRATT

HEALTH AND DISEASE

ENTWICKLUNGSGESCHICHTE DES KRANKHEITSBEGRIFFES. *Wiener Beiträge zur Geschichte der Medizin. Band I. Second Edition.*

By Emanuel Berghoff. Wilhelm Maudrich, Wien; Grune & Stratton, New York. $5.00. viii + 201 pp. 1947.

Before and outside of the Greek tradition, disease was held to be due to supernatural influences. With Hippocrates and Galen, it was derived from a faulty mixture of humors, a hypothesis that survived up to the 19th century. The 17th and 18th centuries provided, in addition, a number of other speculative systems. The 19th century produced the localized, and ultimately cellular, theory of disease, which has been amended by bacteriological, serological, constitutional, and sociological ideas. This whole evolution of the concept of disease is surveyed by the author, a pupil of the great Max Neuburger, competently but without much originality or grace of presentation. In an attempt to embrace too much, only too often too little space is given to a particular development to make the discussion of it very profound or impressive.

ERWIN H. ACKERKNECHT

PATHOLOGY. *An Introduction to Medicine and Surgery. Second Edition.*

By J. Henry Dible and Thomas B. Davie. Grune and Stratton, New York. $11.00. x + 946 pp. + 8 plates; text ill. 1947.

This British textbook of pathology, according to the authors' preface, is based upon lectures delivered to medical students in the Universities of Liverpool, Manchester, and Bristol, and in the London School of Medicine for Women. Probably for this reason, the arrangement of the material is rather unusual. Inflammation is the first subject presented; and then follow the general pathological changes associated with vascular disturbances, cellular damage, growth, and immunity. The second portion of the book deals with special bacterial and viral infections. Here the pathogenesis of each infection is stressed, rather than the associated visceral manifestations. In the third portion of the book, regional pathology is covered so as to include the changes due to the specific infections already described, parasitic diseases, and also non-specific endocrine disorders, diseases of the circulatory, respiratory, alimentary, genito-urinary, nervous, and skeletal systems.

The style of presentation is lucid and interesting, and the many illustrations provide an excellent aid to the understanding of the text. It is unfortunate, however, that the authors' opinions of etiology and pathogenesis are so stressed, and that no bibliography is given to enable the student to read current divergent theories and the historical literature.

ELLA H. OPPENHEIMER

A TEXT-BOOK OF PATHOLOGY. *An Introduction to Medicine. Fifth Edition.*

By William Boyd. Lea and Febiger, Philadelphia. $10.00. 1049 pp. + 30 plates; text ill. 1947.

With this edition, Boyd's *Pathology* undoubtedly becomes the most up to date, complete, and readable of the modern textbooks of pathology. Its format is the same as in previous editions, with a division into two parts. The first part includes a survey of general pathology which gives the principles of degenerative changes, metabolic disturbances, inflammation, and repair, as well as the general nature of specific infections, growth, and tumors. The second part is special pathology and includes a complete survey of the pathological changes found in each system. Pathogenesis is stressed, as well as integration of lesions with functional alterations; and the student is well oriented by a review of normal physiology for each system.

The illustrations are numerous and well chosen and an excellent bibliography is appended to each chapter.

ELLA H. OPPENHEIMER

FUNDAMENTALS OF IMMUNOLOGY. *Second Edition. By William C. Boyd. Interscience Publishers, New York and London.* $6.00. xviii + 503 pp.; ill. 1947.

In this new edition Boyd's book still retains its place as the outstanding text in immunology, having been brought up to date and revised to keep pace with advances in a rapidly expanding field. The general plan of presenting in one volume both basic and advanced material is retained, so that, as the author notes, the book has value to both students and research workers in the fields of immunology. The last chapter of the text, describing a variety of experimental techniques, should again be pointed out as of particular practical interest; for in it both general immunological and specific clinical methods are presented in sufficient detail to form a basis for such laboratory class work as may be desired.

References to the literature of immunology are extensive and comprehensive, so that the interested reader can readily pursue topics into their more controversial phases if he so desires. At the same time, however, these references are in general treated so as not to overwhelm the beginning student.

A sole suggestion might be offered from the point of view of the general biologist—that a later edition ought to include fuller references to the literature

centering around the influence that immunological concepts are having upon the fields of genetics and embryology, for in this synthesis of ideas those contributed by the immunologist are seen to be playing a role of continually increasing significance.

JOHN E. CUSHING

SYNOPSIS OF ALLERGY. *Second Edition.*

By Harry L. Alexander. The C. V. Mosby Company, St. Louis. $4.00. 255 pp.; ill. 1947.

In 1941, the author first published his concise and clear *Synopsis of Allergy*, a handbook which has succeeded well in its purpose of providing the student and the physician with a practical conception of the fundamentals of the allergic state and a working knowledge of problems connected with the diagnosis and treatment of its several clinical forms. Another edition of this volume is now needed. The basic information in this field has altered but little in the intervening years, but our conceptions regarding portions of it have gradually shifted. Advances made in the subject are evident from the appearance of some new complexities and many simplifications.

In his position as Clinical Professor of Internal Medicine at the Washington University Medical School, and particularly from his vantage point as editor-in-chief of the *Journal of Allergy*, Alexander has been fully aware of these trends. It must have been a temptation to him, therefore, to increase the scope and possibly the bulk of his second edition, by inciuding in detail many of these ideas and developments. Wisely, it would seem, he has adhered to his original purpose. He has brought his volume up to date but he has retained its brevity and succinctness.

The opening pages deal with the classification of allergic disorders, and their characteristics. The general problems of diagnosis are clearly stated in discussing the technique of collecting clinical data, the value of general laboratory procedures, and the specific test with allergenic extracts by intradermal, ophthalmic, and nasal routes. General measures for avoiding specific offending substances, as well as specific immunization procedures with extracts of the implicated agents, are presented. Tables of dosages of specific extracts, showing schedules of injections, are given with the increases indicated. Such recommended increases are frequently so small as 0.03 cc., even where extracts of such high potency as 10,000 protein N units per cc. are employed. In very sensitive patients, increments of dosage by hundredths rather than tenths of a cc. are prescribed. With such delicate increases in dosage, errors in measurement would seem to be difficult to avoid, even though the clinician provides himself with special syringes. More accurate doses could be attained by employing less potent extracts with larger increments. Oral immunization measures employed against specific food sensitizations are featured, being given more space, it would seem, than their value deserves.

The chapters upon bronchial asthma and upon hayfever contain comprehensive discussions upon etiology, methods of diagnosis, specific therapy, and various non-specific therapeutic procedures. In the section upon hayfever, consideration of all pollens of purely local importance has wisely been omitted, along with all pollen census figures for the various sections of the United States. Of practical value is the table of ragweed pollen distribution, which is given near the close of the book.

In the chapter upon allergic dermatoses, Alexander has discussed acute and chronic urticaria, allergic purpura, neurodermatitis, and contact and fungus dermatitis. Means of detection and of treatment are given, many prescriptions for local use being included. Adequate discussion is given to the various forms of occupational dermatitis, which have greatly enhanced the importance and the complexity of this form of allergy within recent years. Gastrointestinal, physical, drug and serum allergies are concisely treated. The appendix contains such important and necessary information as methods of preparing diagnostic allergenic extracts for intradermal use. There are lists of the more important of such specific extracts, e.g., of pollens; of the non-seasonal inhalants such as animal danders, vegetable powders, etc.; and of the principal foods which are most regularly employed in skin testing. The potencies proper for testing are designated, and the several methods of determining the specific activity of diagnostic and therapeutic extracts are compared. The patch-testing procedure is described. The author has shown much restraint is preparing this new edition —many theories and speculative ideas could easily have crept in, which would have defeated the purpose of the book. Alexander is to be congratulated upon providing a concise, accurate, and practical compendium upon allergy.

W. C. SPAIN

BUILDING SKIN BEAUTY.

By Mary MacFadyen; illustrations by Frank H. Netter. Emerson Books, New York. 25 cents (paper). 32 pp.; ill. 1947.

This, a paper-bound pamphlet for streetcar reading by the maiden or matron, and containing thirty pages, gives good advice on everyday skin care of the face and hands. Unfortunately it does not state which soaps are "strong" and which are "mild," nor does it mention the growing importance of detergents as substitutes for soap. "Cold cream" is not defined, nor is the quackery in the sales-talk jargon boosting many so-called

"creams" pointed out. A short, sound discussion of acne vulgaris is presented, although the role of diet, held to be a cause of this disease, is probably incorrect. The author might well have included a paragraph on ill effects of over-exposure to the sun.

HANFORD H. HOPKINS

ESSAI DE PHYSIOPATHOLOGIE THYRO-HYPOPHYSAIRE. *Etudes cliniques, thérapeutiques et expérimentales.*

By Jacques Mahaux, with preface by E. J. Bigwood. Masson et Cie., Paris; Editions Desoer, Liège. 530 fr. (paper). x + 267 pp. + 1 table; ill. 1947.

According to Mahaux, the thyrotrophic factor of the pituitary has two functions. One is to stimulate the thyroid gland; the other is to combine with the thyroid hormone to form a physiologically active complex. This complex is supposed to have a specific stimulating action on the vegetative centers of the hypothalamus. Mahaux cites a number of facts from the literature and from his clinical and laboratory experience, which have led him to his theory. Certain doubts may be entertained as to the validity of the author's arguments. However, the book is well written and likely to stimulate fresh thinking. A great number of authors, cited in the text of the book, fail to appear in the bibliography. This is indeed to be regretted, for the author seems to have made an extensive study of the pertinent literature in order to prove his point.

WALTER FLEISCHMANN

ENDOGENEOUS ENDOCRINOTHERAPY. *Including the Causal Cure of Cancer Compendium.*

By Jules Samuels. Holdert and Company, Amsterdam. $10.00. 541 pp. + 38 plates. 1947.

The author's system of medicine is based on three assumptions: first, that many major diseases, such as, for instance, hypertension, chronic arthritis, cirrhosis of the liver, multiple sclerosis, gastric ulcer, and cancer, are due to an unbalance of the production of pituitary hormones; second, that this unbalance of pituitary hormones can be determined by spectroscopic examination of the blood; and third, that these diseases can be cured by irradiating the pituitary gland with short waves. The author is very confident in the value of such therapy. In the chapter on carcinoma of the breast the author writes: "*We must therefore endeavor to get the patient for treatment if possible already in the first or second stage.* If the woman is informed—by making it widely known—of the good results which are obtained at these stages with a harmless method of treatment, causing her no pain, *especially that she will be cured, retaining her breast, then she will not hesitate to apply for treatment already at the first symptoms*" (p. 504—italics in original). The few and sketchy case histories and the lack of any statistics make it difficult, if not impossible, to evaluate the author's claims. The reviewer could not be convinced that the book contains anything of value except the bibliography.

WALTER FLEISCHMANN

MÉTHODE GÉNÉTIQUE ET TUBERCULOSE PULMONAIRE. *Travail de la Clinique de la Tuberculose de l'Hôpital Laennec et de l'Institut National d'Hygiène.*

By Jean Troisier and J. van der Stegen. Masson et Cie., Paris. 45 fr. (paper). 103 pp.; ill. 1944.

The contents of this diminutive monograph, published in France during the war, consist of two heterogeneous sections. In the first part, the authors review earlier studies on genetically determined variations in susceptibility to tuberculosis. From there they proceed to prepare the reader for a more complete appreciation of their own work by explaining some elementary facts of inheritance regarding blood groups, eye color, and the capacity for tasting PTC.

The second part is a poorly tabulated and statistically naive report on the authors' investigation of the offspring of 9 sets of parents, one of whom had clinical tuberculosis. By comparing the eye color, blood group, and cranial indices of 15 tuberculous and 14 nontuberculous children with those of their parents, they set out to find certain hereditary traits associated with prognosticable susceptibility to tuberculosis. To the surprise of no one familiar with the inadequacy of their procedure, they found them. Without reservation, the book can be recommended for the purpose of demonstrating how studies in human genetics should not be conducted.

FRANZ J. KALLMANN

A GUIDE FOR THE TUBERCULOUS PATIENT.

By G. S. Erwin; American edition revised and edited by Henry C. Sweany. Grune & Stratton, New York. $1.50. x + 126 pp. 1946.

The clearly stated and fully accomplished purpose of this unpretentious book of popular appeal is the education of the tuberculous patient with respect to the nature, the various methods of treatment, and the public health aspects of his illness. The etiologic, diagnostic, and social problems of the disease are discussed in plain language and with a minimum of technical terms, which are fully explained. All the practical directions given with regard to the emotional, eugenic, and economic aspects of readjustment are sound, well formulated, and free of banal generalizations. In fact, the booklet contains so many essential facts about the clinical and social pathology of tuberculosis, and it presents them in so easily digestible a

form, that it can be fully recommended not only to those suffering from the disease, but also to any other student of this particular subject.

FRANZ J. KALLMANN

HEARING AND DEAFNESS; *A Guide for Laymen. Edited by Hallowell Davis. Murray Hill Books, New York and Toronto.* $5.00. xvi + 496 pp.; ill. 1947.

Thirteen authors have collaborated with Hallowell Davis in producing this book, which also has a Foreword by Louise Tracy, and an Introduction by C. Stewart Nash. The book is divided into six main sections, with a total of 19 chapters. The first chapter, written by the editor, Hallowell Davis, is also the first section and is really a further introduction to the problems of hearing and deafness as they are covered in this book. The aims and plan of the book are described here. The second section covers general problems of hearing and hearing loss, and includes four chapters. Two chapters, one on the physics and psychology of hearing, the other on its anatomy and physiology, were written by Davis. There is also a chapter on the medical aspects of hearing loss, by E. P. Fowler, and a chapter on the surgical treatment of hearing loss, by T. E. Walsh. The third section has two chapters on tests of hearing and hearing aids, and one chapter on the choice and use of hearing aids, by S. R. Silverman and S. Gordon Taylor.

The fourth section covers problems of rehabilitation, with chapters by M. D. Pauls on speech reading, on auditory training and conservation of speech by R. Carhart, and on military aural rehabilitation by N. Canfield and L. E. Morrissett. The fifth section discusses education and psychology, with three chapters on deaf and hard-of-hearing children by S. R. Silverman, and one chapter on the psychology of the deaf adult by D. A. Ramsdell. The last section is on social and economic problems, with three chapters: B. C. Wright discusses organizations for the deaf; A. M. Hill, employment problems of the deaf; and H. R. Myklebust, vocational guidance. There is in addition an excellent appendix of word lists used in various tests of deafness which should prove useful to audiologists in general.

In a review of a book that is an edited compilation like this one, it is sometimes difficult to discuss certain sections of the book without doing an injustice to other authors. With this book it is not really necessary to discuss individual sections. Every contributor is well qualified to write on his chosen topics, and every one has done a good job. The aim of the book was to provide information about hearing and deafness for the intelligent layman, and for workers in this field as well. It is almost enough to say that this aim has been accomplished as well as it seems possible. The language is non-technical wherever possible, but there is no sacrifice of scientific truth or facts. The many writers have apparently worked together well, for it is almost impossible to detect any major differences in the style of writing from chapter to chapter. Difficult concepts are discussed with utmost clarity, and the nontechnical language of the book does not at all detract from its value as a source of information.

The reviewer is, in fact, enthusiastic about the book. There have been so many attempts to write good scientific material for public consumption which have failed, either because in popularization truth and facts have been sacrificed, or because the writer has really failed to make his language intelligible to the layman. Neither of these difficulties can be found here. The writers set out to accomplish a worthwhile aim, and they have certainly achieved it.

W. R. GARNER

AMERICAN MEDICAL RESEARCH, *Past and Present. A Monograph Study of the New York Academy of Medicine Committee on Medicine and the Changing Order. By Richard H. Shryock. The Commonwealth Fund, New York.* $2.50. xviii + 350 pp. 1947.

Medical research, and research in general, enjoy by now in this country almost the prestige they deserve. This is a relatively recent development. In a chapter on formative influences the author shows for what economic and moral reasons medical research did not develop on a large scale in this country during the greater part of the 19th century. Some of these trends still subsist, as evidenced by the amount of time and energy wasted by the medical profession almost every year in almost every state in order to maintain the right of animal experimentation.

Early support for medical research was obtained in the period 1860–95 primarily in the field of veterinary medicine, under the influence of the practical success of the new bacteriology, and under the impress of German systems of research organization. Still, in its first period of great achievement American research was, more than research in any other country, dependent upon private support. The author has analysed the different forms of private support under the several headings of the foundations, professional institutions, universities, and corporations.

Every war since 1860 has brought increasing governmental support to medical research, a trend culminating in the giant enterprises of the Committee on Medical Research during World War II and the plans expressed in the Kilgore, Magnusson, and other bills.

Besides an accurate description of the organizational forms of research, Shryock has also supplied a competent survey of the contents of 20th century research, its trends, fields, and the reciprocal influences of research and practice. A special chapter is devoted to the

"public relations" of medical research, and in a thoughtful finale an attitude of "qualified optimism" is adopted.

One of the outstanding virtues of this book is that technical details are organically connected with social background and general trends. It is a most artful blending of historical analysis and recent survey, or, to say it in medical terms, of anamnesis, physical examination, and prognosis. It does not remain on the descriptive level; its courageous criticism leads up to well-balanced judgments. It confirms the author's position as one of the leading medical historians in this country. It should be read by everybody interested in either science or history.

ERWIN H. ACKERKNECHT

STANDARD METHODS OF THE DIVISION OF LABORATORIES AND RESEARCH OF THE NEW YORK STATE DEPARTMENT OF HEALTH. *Third Edition.*

By Augustus B. Wadsworth, with a foreword by Gilbert Dalldorf. The Williams & Wilkins Company, Baltimore. $10.00. xxxvi + 990 pp.; ill. 1947.

This valuable book of laboratory procedures has been revised and on the whole brought very well up to date. There are new chapters on the Spectroscopic Laboratories, on Gasometric Analysis, and on Biologic Assay. A complete revision has been made in the routine methods for the serological diagnosis of syphilis. The new antigen composed of cardiolipin, lecithin, and cholesterol has been substituted for the cholesterolized alcoholic extract of beef heart. The chapters on Actinomycosis and Mycotic Diseases, Protozoa, and Parasitic Worms have been greatly enlarged.

Many of the culture media recommended are still those of the 1939 edition. The newer peptones that are now being used in place of infusion bases have not been included. A direct plating medium for the detection of *C. diphtheriae* is not advocated. Laboratory diagnosis of diphtheria is still based on the microscopic examination of cultures on coagulated-serum medium. Endo and eosin methylene blue plates are still recommended for use, along with bismuth sulfite and citrate agars, for the enteric group. No mention is made of DCLS or SS. These examples illustrate some of the more glaring omissions.

New sections have been included on the preparation of fluid tetanus toxoid, on precipitated diphtheria-tetanus toxoid, on enzyme concentration of antitoxic sera, and on the preparation and standardization of phase I pertussis vaccine.

The appendix contains the provisions of the New York State laws and Sanitary Code relating to Approved Laboratories, postal laws and regulations regarding the mailing of specimens and cultures of pathogenic micro-organisms, and a description of outfits used for the submission of specimens.

This volume definitely belongs in the libraries of all medical and public health laboratories for its wealth of readily available information.

E. PETRAN

PSYCHOLOGY AND ANIMAL BEHAVIOR

CURRENT TRENDS IN PSYCHOLOGY.

By Wayne Dennis, B. F. Skinner, Robert R. Sears, E. Lowell Kelly, Carl Rogers, John C. Flanagan, Clifford T. Morgan, and Rensis Likert. University of Pittsburgh Press, Pittsburgh. $3.50. x + 225 pp. 1947.

On March 5 and 6, 1947, a conference on current trends in psychology was held at the University of Pittsburgh. Specialists in various fields of psychology were asked to speak on trends in their fields, and this book contains these various discussions on the status of the different fields as seen by the speakers. One chapter in the book is given over to each of the talks.

In the first chapter, Wayne Dennis discusses Psychology as a Profession. Psychology has grown tremendously in the past few years, and this growth has led to many new problems. The public has, during this period of growth, come to accept psychology more and more. This growth and acceptance lead to many problems with which psychologists have not had to contend before, namely, problems such as the certification of psychologists and restrictions on the use of the term. Dennis feels that psychologists should spend a little more time applying certain psychological principles to their own problems of selecting and training personnel.

B. F. Skinner writes on Experimental Psychology. To Skinner, experimental psychology can no longer be defined in terms of a restricted subject matter. Most fields of psychology are now experimental. The thing which distinguishes the experimental psychologist is his interest in understanding behavior and in formulating theories to account for behavior. At least that is what the experimental psychologist should be doing. Skinner is concerned primarily with the *academic* experimental psychologist, and his remarks do not seem so much to indicate a trend as to indicate what he thinks they ought to be doing, and perhaps what the academic psychologist will be forced to do. It seems to the reviewer that the main trend in experimental psychology is that it is moving out of the academic atmosphere in many places. The subject matter of experimental psychology has become complicated, and better experimental facilities are required. The academic psychologist may be the only one left to take care of theory, and in turn theory may be all that is left for the academic psychologist.

Robert R. Sears, in his chapter on Child Psychology, tells us that the subject matter of this field is changing. Now there is more emphasis on the molar, rather than

egmental, behavior of children; more emphasis on the earning process; and more emphasis on the social setting. Child psychology shows a trend toward a ystematic molar theory of development. In this rend, some of the older techniques of tests and instrumental recording are dropping out, and newer techniques of observational sampling and projective tests are being used. These do seem to constitute a trend in child psychology.

E. Lowell Kelly discusses Clinical Psychology. The major trend here is that there are getting to be so many clinical psychologists. Clinical psychology was long scorned and shunned by the very departments which are now turning out hundreds of clinical PhD's. These many new psychologists, now practising, bring about many of the certification and training problems mentioned earlier by Dennis. Another trend in clinical sychology is toward development of the psychiatric eam, made up of a psychologist, a psychiatrist, and a social worker who diagnose and treat as a team. Kelly is very much in favor of this type of teamwork.

Carl R. Rogers, writing on Psychotherapy, feels that the main trends in this field are toward objectivity in therapy, and toward client-centered therapy. He s probably right, if published literature is a good indiation. Rogers disagrees with Kelly, however, in his eeling that team therapy is dropping out and that ndividual therapy is becoming more important.

John C. Flanagan, in Personnel Psychology, discusses he history of individual differences. He finds no good formation derivable from an analysis of publications, ut his analysis is in terms of percentages, not number of ublications. The major trend for the future seems to e that there will be much more personnel selection.

Clifford T. Morgan writes about Human Engineering, and briefly discusses its history, which was primarily during the years of the recent war. Human engineering is concerned mainly with the working environment, work and the workplace, and the design of instruments. During the war, much of the research on these problems was applied, useful in a limited area of application. More and more emphasis is being placed on fundamental research in this area, and we already see evidence of the great amount of work which can and needs to be done. In a way, human engineering is the one really new development in psychology, having had its greatest growth in the last ten years.

Rensis Likert, in the last chapter, discusses the Sample Interview Survey. He illustrates the information which can be obtained from the sample interview with a national survey by the Department of Agriculture for the Board of Governors of the Federal Reserve System. This illustration also shows very carefully the requisite steps in undertaking a large scale interview. Likert's main prediction of trends arises from his own enthusiasm for the method and his confidence that surveys will be an important research tool in the future.

In summary, this book has some useful information. Probably all writers are overly enthusiastic about their own fields, and each feels that his own area of interest is becoming more important relative to the others. The truth is probably that all fields of psychology have grown greatly in the past few years, and will continue to grow in the future. There is much less *shift* of emphasis than simply an *increased* emphasis on all fields. It is unfortunate that Physiological Psychology was omitted, since it too seems to have its trends; but there were apparently practical considerations which made it impossible to include this field.

W. R. GARNER

THE PSYCHOLOGY OF NORMAN PEOPLE. *Revised Edition.*

By Joseph Tiffin, Frederic B. Knight, and Eston Jackson Asher. D. C. Health and Company, Boston. $3.50. xvi + 581 pp.; ill. 1946.

This book is the second edition of a textbook for courses in Introductory Psychology. In most respects the book is not different from the first edition, with the exception of some minor rearrangement of chapters, and the addition of some new material in a few of the chapters. The text was written primarily for students not expecting to specialize in psychology, but expecting to go into fields of business, engineering, etc. The emphases, in accord with the expected use of the text, are on individual differences, personality, and similar topics. The writing is readable, and illustrations are ample, features which make this text reasonably satisfactory for many courses.

W. R. GARNER

THE PSYCHOLOGY OF EGO-INVOLVEMENTS: *Social Attitudes and Identifications. Wiley Publications in Psychology.*

By Muzafer Sherif and Hadley Cantril. John Wiley & Sons, New York; Chapman & Hall, London. $6.00. viii + 525 pp. 1947.

The authors of this book use the word *ego* reluctantly, because the word has been used in so many ways that they are afraid that their own meaning will be misinterpreted. Thus they are careful to state explicitly what they mean when they use the word *ego*. To them, "the ego consists of many attitudes which from infancy on are related to the delimited, differentiated and accumulating 'I,' 'me,' 'mine' experiences. These attitudes, which may be designated as ego-attitudes, are constituent components of the ego. Apart from the constellation of these ego-attitudes, there is no such entity as the ego." With this definition of the ego, their study becomes primarily a study of attitudes,

particularly those attitudes which are self-oriented or directed.

The first few chapters are concerned primarily with an experimental study and definition of the ego. Can it be demonstrated in the laboratory? Under what conditions is the ego an effective concept in describing the nature of perception? The authors find certain relations to hold. Ego-attitudes determine the nature of a perception when the perception is otherwise loosely organized. And instructions have the greatest effect when they are in accord with the subject's own attitudes. Relations such as these are found in experimental literature, and certainly add weight to these authors' concept of the ego as an objectively identifiable part of an individual.

The authors insist that the only ego they are interested in is one which can be objectively demonstrated, one which is not mysteriously innate, one which is dependent on environmental training and momentary environmental stresses. Particularly in the first half of the book they make out a good case for such an ego. Their ego seems to be one which can be experimented on in the laboratory. But inasmuch as their definition of the ego is in terms of attitudes, the last half of the book deals primarily with many illustrations of the ways in which attitudes are formed and changed, the development of attitudes, and the importance of attitudes. In these illustrations, the authors seem to keep clearly in mind that they are dealing only with self-oriented attitudes, and many of their points seem well made. At times one is reminded a little too much of the case-history variety of books on sociology, and the book becomes progressively weaker toward the end—weaker in terms of holding to an objective ego.

The authors have provided us with a book which is interesting to read, although the language is rather involved at times. They have made a case for an objective ego, and thus have made a significant contribution, since it seems to the reviewer that any successful attempt to objectify even some of the concepts of personality and social psychology must be a significant contribution.

W. R. GARNER

PSYCHOLOGY FOR NURSES.

By Mandel Sherman. Longmans, Green and Company, New York, London, and Toronto. $2.75. xvi + 237 pp. + 2 plates; ill. 1947.

This is an "easy" textbook of general psychology with content especially chosen for interest to nurses in training. The topics of sensation and perception are sacrificed for an expanded treatment of intelligence, mental tests, and emotions. The text is written in a pleasant, readable style, and to each chapter there is appended a list of questions for discussion. The book appears to be admirably suited for its purpose and might well be adapted to other terminal short courses, because it is both "popular" and sound.

STANLEY B. WILLIAMS

HOW OUR MINDS WORK.

By C. E. M. Joad. Philosophical Library, New York. $2.75. viii + 116 pp. [No date.]

Joad is a philosopher and he has presented us with a quaint and well-mannered essay on the ancient and familiar mind-body problem. This is an issue which vexed psychology more a generation ago than it does today, and unfortunately Joad's treatment of it is of about that vintage. Though in part the issue may prove to be a timeless one, the essay might have benefited from more consultation of recent psychological thought. Joad writes persuasively and concisely and has, in surprisingly few words, stated the case for a modified idealism, a view which makes a place for a separate entity or force called "mind."

STANLEY B. WILLIAMS

THE THINKING MACHINE.

By Edward Podolsky. The Beechhurst Press, New York. $3.50. 232 pp. + 8 plates; ill. 1947.

This book contains a close-up photograph of the brain of the Nazi, Robert Ley. Otherwise there is nothing in it to interest the scholar, and much to make him cringe. The reputable scientists who find their experiments summarized here may well wonder whether it is worth being popularized if it has to be done in a context of ignorance.

STANLEY B. WILLIAMS

DEVELOPMENTAL DIAGNOSIS: *Normal and Abnormal Child Development. Clinical Methods and Pediatric Applications. Second Edition.*

By Arnold Gesell and Catherine S. Amatruda. Paul B. Hoeber, New York and London. $7.50. xvi + 496 pp.; text ill. 1947.

Again Arnold Gesell, with his associate Catherine Amatruda, presents a well-written, thoroughly scientific, practical, and comprehensive volume on child development. The thesis of this book is that by a careful examination of an individual child, with reference to behavior norms for specific ages, a physician may identify behavior abnormalities in patients as early as the age of 8 weeks. Early diagnosis of amentia in any degree, of diffuse or specific brain lesions, of precocity, of blindness, or of deafness is a great advantage in hand-

ling a child and directing his subsequent development intelligently.

Developmental Diagnosis is a handbook, really, for every physician who sees children. Part I informs the clinician how to examine a child's behavior responses accurately. Norms for infants from 4 weeks to 36 months are given, and the procedure for equating a child's "developmental quotient" is carefully described. Part II is devoted to detailed but never labored discussions of twelve types of abnormalities which affect the total development of children. In this section a number of succinct developmental histories amply illustrate the effectiveness of the authors' methods. Throughout the book emphasis is consistently placed on the doctor's responsibility to recognize and help patient and family deal with actual developmental capacities realistically. In Part III this point of view is further amplified by a chapter on Diagnosis and Guidance and a second on Developmental Pediatrics.

It is a great satisfaction to know that this book has now appeared in a second and expanded edition. This is indicative of a demand in pediatric medicine for better understanding of individual children, their individual growth potentialities, and their individual needs.

HELEN HEWITT ARTHUR

THE PERSONALITY OF THE PRESCHOOL CHILD. *The Child's Search for His Self.*

By Werner Wolff. Grune & Stratton, New York. $5.00. xvi + 341 pp.; ill. 1946.

Personality dynamics, as expressed in the child's search for himself, is the contribution of this extensive volume. Overt child behavior has been fully investigated by Gesell and others, but the underlying forces that motivate this behavior have not been understood. An essential feature of Wolff's approach is revealed in his opposition to Piaget, as expressed (pp. 17–18) in the belief that a child is more concerned with thoughts than with objects, is more original than imitative, and has thoughts unrealistic rather than exclusively realistic. To support these theses and many others, a tremendous amount of recorded material is advanced. These illustrative excerpts do much to confirm the reader in the belief that "from the viewpoint of adult behavior, the child's attitudes have the characteristics of pathological or even schizophrenic reactions" (p. 31). They may also be said to be the only sections of the book that are easy to read. The author's style is a difficult one. Many of the sentences are very Germanic in structure and length. Beyond this, there are instances of incoherence, reminiscent of the very thinking of preschool children! An example reads: "The formation of an ideal is based upon the child's tendency to imitation, whereby the child tries to adjust himself to his environment. Experiencing that he is not able to have the same power and success as those people whom the child wishes to imitate, these persons become ideals" (p. 55). To be perfectly fair it must be said, too, that there are passages of great clarity; and by evading the sections containing spiritualistic and mystical overtones, some examples of fine prose may be found.

The first section, entitled Observation, is the part of the book perhaps least open to criticism. One can quarrel very little with the recorded data here, although the interpretations are certainly highly subjective in many instances. An illustration of the growth of "genuine social relationships and mutual understanding" shows at least some aggressive tension if the whole dialogue is examined:

Philip: "Oh, I dropped my stick."

Henry (retrieving it clumsily): "I picked up your stick for you. Wasn't that nice of me, Philip? Wasn't that nice? [Pause—working at clay.] We won't stop this all day—we'll just stay here. We'll be here all the time—all alone. The grownups will be dead. We'll hurt them dead and they won't be here. We'll be playing with the dumb-waiter all the time. I pull it up and you pull it down." (p. 63.)

This is interpreted as the effect of resentment against adults assisting in the development of social relationships. Obviously other interpretations may be made.

The second section, Experimentation, is even more open to question in regard to some of the reported findings. Here dreams, drawings, stories, and behavior of children are interpreted by "expressive analysis." The individual associations of the children are the bases of the interpretations. Explanation of the title of this section is hard to find.

The discussion of the Binet intelligence test measuring emotion is interesting but unconvincing. The thesis seems to be that in responding to a question designed to measure intelligence, e.g., "What's the thing for you to do when you are on your way to school and see that you are in danger of being late," a child expresses an emotion, "I would go home." This tells about the child's psychic tensions, negative environment, etc., says Wolff, "but nothing about intelligence." This certainly seems to require proof!

The third section, entitled Theory, is indeed a highly theoretical treatise. Many interesting and challenging possibilities for further research are presented. Wolff's comparison of his own approach, "experimental depth psychology," with those of Claparède, Stern, and Gesell is worth reading, as is his description of the steps and techniques of what he calls "experimentation."

A word of appreciation should be given to the childrens' drawings, which are most delightful and do much to brighten the text. The typeface is well chosen. There is an author index, a subject index, and a bibliography of 628 titles.

ARTHUR LICHTENSTEIN

THE PSYCHOLOGY OF ADOLESCENCE. *Third Edition. Prentice-Hall Psychology Series.*

By Karl C. Garrison. Prentice-Hall, New York. $4.65 (trade edition); $3.50 (text edition). xx + 355 pp.; ill. 1946.

This third edition of Garrison's textbook is similar to the previous ones. It is divided into four sections, an introduction, a section on the facts of development during adolescence, a section on the personality of the adolescent, and a final section on guidance.

It is a self-contained elementary textbook. It introduces the various topics with sufficient background to make them intelligible without much prerequisite knowledge. It is thoroughly documented from empirical investigations of adolescence, and it presents both sides of many controversial issues—in other words it is a scholarly presentation. It is a factual book with a minimum of theoretical interpretation. As such it certainly serves a function. It is probably useful reading for either an adolescent or his parent. The central weakness of the book is its failure to picture the adolescent as a live, understandable person. After reading the book, an adolescent may know that other people are having the same troubles as his, but he is not likely to understand the reasons for his feelings. The parent is not helped to see the world through the eyes of an adolescent. The notable absence of reference to psychoanalytic ideas about adolescents indicates a lack of emphasis upon the internal dynamics. In other words, the book is accurate and academically scientific, but it lacks warmth of understanding of personality. Rather surprisingly, the bibliography includes a selection of fictional treatments of adolescence.

ALFRED L. BALDWIN

IMPROVABILITY OF PITCH DISCRIMINATION. *Psychological Monographs, Volume 58, Number 2, Whole Number 267.*

By Ruth F. Wyatt. The American Psychological Association, Northwestern University, Evanston, Illinois. $1.25 (paper). vi + 58 pp. 1945.

In this significant study it is shown that both muscially trained and untrained subjects can improve their pitch discrimination by special training, to a point where the musically untrained subjects are better at the end of training than the musical subjects were to start with, although of course the latter have continued to keep ahead. Training at one frequency is transferrable to a significant degree to octave frequencies on either side of the training frequency, but improvement is not so great as at the training frequency.

PSYCHOLOGICAL TESTING.

By James L. Mursell. Longmans, Green and Company, New York, London and Toronto. $4.00. xiv + 449 pp. 1947.

The mental testing movement is nearly a half century old, yet it still is almost impossible to find a good up-to-date handbook for use in advanced college courses. Handbooks, special-topic books, yearbooks, critiques, and journal articles are abundant but generally lack one feature or another required of a genuine introduction to the field. Mursell has by no means supplied the perfect text, but he has done a creditable job of trying to. His book leaves the impression of having been written by a teacher rather than by a researcher. Quite a lot of it is assembled rather obviously from secondary sources, some of it uncritically. The teacher's emphasis, too, is apparent in the selection of topics. Mursell evidently wants the student to understand the general logic of test construction and interpretation, in clear English words and sentences, and to steer clear of many controversial issues. As a teacher, I should say he succeeds quite admirably in this, as well as in giving a fair portrayal of the status of psychological tests today. His keynotes are caution in interpretation and fairness to all views, marks of eclectic scholarship. No one could write such a text and not be superficial at times, or fail to omit what others regard as significant, or occasionally conclude just the opposite of what some specialists have established. Mursell is no exception. But the paucity of good textbooks in this field may just possibly reflect a basic difficulty of subject matter rather than the inabilities of authors. A well-informed teacher could use this textbook to good advantage, for basically it is sound and scholarly. It can be read with profit even by one who doesn't yet know what this "IQ and mental test stuff" is all about.

As to topics, Mursell devotes far and away the greatest share of space to the main stream of intelligence testing. The treatment of personality and motor-functions is cursory, as is the treatment of special analytic procedures such as factor analysis. Nor are the test developments of the recent war adequately covered. Nevertheless, it must be admitted that adequate coverage of all topics would require a much larger book than would be practicable. Until the definitive treatment appears, this book will serve as a useful substitute.

STANLEY B. WILLIAMS

THE RELATIONSHIP BETWEEN CONTENT OF AN ADULT INTELLIGENCE TEST AND INTELLIGENCE TEST SCORE AS A FUNCTION OF AGE. *Teachers College, Columbia University Contributions to Education, Number 933.*

By Rose Estrin Kushner. Bureau of Publications, Teachers College, Columbia University, New York. viii + 59 pp. 1947.

This is a technical monograph of little or no interest to the general or scientific public. It deals with a specific

problem of interest only to mental test constructors. Certain subtests in adult intelligence tests are shown not to influence the total score differentially with age, as had been supposed by other investigators.

STANLEY B. WILLIAMS

THE THEMATIC APPRECEPTION TEST. *The Theory and Technique of Interpretation.*

By Silvan S. Tomkins with the collaboration of Elizabeth J. Tomkins. Grune and Stratton, New York. $5.00. xii + 297 pp. 1947.

Recent years have seen the rise of the so-called "projective" tests of personality, which rely not on direct questioning but on indirection. A person is asked to supply the meaning to an essentially ambiguous situation—ink-blots, unfinished sentences, muffled speech, or the like—and in so doing is likely to reveal quite unintentionally a great deal about his innermost wishes, fears, and habits of thought. The tests are claimed by admirers to be analytic of basic personality structure but by others are regarded merely as convenient ways of getting people to speak frankly of personal matters. The best known and most studied are the Rorschach ink-blots. The Thematic Apperception Test (TAT), developed by Murray and his associates at the Harvard Psychological Clinic in the 1930's is becoming nearly as popular as the ink-blots. Its unique character is the use of pictures of people in *social* situations, such as might appear as illustrations for a magazine story. The required test behavior is the elaboration of a story to fit each of 20 standard pictures. In telling the stories the testee draws on his imaginative resources without restraint and often can keep a hidden stenographer very busy with verbatim recording. Records are even more laborious to analyse and interpret than to transcribe. There are, as yet, few standard rules that are generally accepted among the "trade," although most investigators hope that such rules will be worked out eventually. Until they are, the stories will continue to be evaluated—just as are people—according to one's own brand of personality theory. The degree of subjectivism introduced thereby is the degree to which the projective test is not a true measuring instrument of scientific value. Admittedly, it takes years of patient research to achieve genuine standardization. Tomkins outlines in his book a tentative method for interpreting the stores, which, it is hoped, will further the progress of standardizing. The method is his own and is slightly different from the original method of Murray.

Most of the pages of this book are taken up with illustrative case material, which is more voluminous, perhaps, than is necessary. The historical introduction is too brief to be satisfactory. Of chief interest are two sections: the first, an application of Mill's principles of logical analysis (methods of agreement, concomitant variation, etc.) to the story material; the second, a novel statement of the theory of repression, cast in quantitative terminology. Neither contribution is sufficiently integrated with the TAT material. However, despite these shortcomings, the book is the best over-all treatment of the TAT and will for that reason alone find a place in the library of the clinician as a useful reference.

STANLEY B. WILLIAMS

MENTAL MISCHIEF AND EMOTIONAL CONFLICTS. *Psychiatry and Psychology in Plain English.*

By William S. Sadler. The C. V. Mosby Company, St. Louis. $6.00. 396 pp. 1947.

This is an addition to the rapidly growing bibliotheca of popularized psychiatric-psychological literature, but it is superior to much of this material in a number of respects. The author's competence is beyond question. His style is lucid, and his explanatory passages really explain. The illustrative cases are wisely selected, not for sensationalism or melodrama, but for clarification of the exposition.

While tracing the sources of symptomatized phenomena of mental illness and related areas well below the surface, the author handles theories and concepts, the adequacy of which is yet to be fully demonstrated, with admirable reserve. Two illustrations may suffice: (1) the discussion of telepathy (Chapter 26); and (2) the references to psychoanalysis (several places, particularly Chapter 20). The latter Chapter, on Sexual Problems, is incidentally very well-handled throughout.

One feature of the book that proved most annoying was the frequent indulgence in upper case and italic type, particularly the latter. This gives the page a MOST *sensational* appearance, fortunately quite misleading. In many instances it is impossible to find any logical basis for this procedure, unless it be variety in visual stimulation.

In sum, in view of its sound, comprehensive approach and wealth of useful case material, this is a justifiable addition to the library of the physician, psychiatrist, or psychologist, and for the layman a book several strata above the general run of the popular psychological mill.

ARTHUR LICHTENSTEIN

PSYCHIATRIC RESEARCH. *Papers read at the dedication of the Laboratory for Biochemical Research, McLean Hospital, Waverley, Massachusetts, May 17, 1946. Harvard University Monographs in Medicine and Public Health, Number 9.*

By Cecil K. Drinker, Jordi Folch, Stanley Cobb, Herbert S. Gasser, Wilder Penfield and Edward A. Strecker. Harvard University Press, Cambridge. $2.00. xii + 115 pp. + 5 plates; ill. 1947.

In this little volume of dedication papers, Cecil K. Drinker begins with a historical account of research at the McLean Hospital. Jordi Folch follows with a discussion of Biochemical Problems Related To Psychiatry; Stanley Cobb discusses the Integration of Medical and Psychiatric Problems: A Report of Progress; Herbert S. Gasser offers a Protocol For A Review Of Psychiatry; Wilder Penfield contributes a paper on Psychical Seizures; and Edward A. Strecker concludes with a discussion of The Psychobiology Of Psychiatric Research. These papers set a rather high standard, and several of them bring together into convenient form considerable new material for which the reader would otherwise have to comb the literature.

WENDELL MUNCIE

PRACTICAL PSYCHIATRY AND MENTAL HYGIENE. *McGraw-Hill Series in Nursing.*

By Samuel W. Hartwell. McGraw-Hill Book Company, New York and London. $3.75. xvi + 439 pp. 1947.

This is a textbook in psychiatry and mental hygiene, particularly for the use of nurses. As such it is very readable, contains no gross errors, presents an eclectic view on problems in mental hygiene, and offers an extensive bibliography, glossary, and outline for history-taking. It is amply illustrated with psychiatric cases and emphasizes the mental hygiene of childhood and adult life.

WENDELL MUNCIE

TEACHING PSYCHOTHERAPEUTIC MEDICINE. *An Experimental Course for General Physicians.*

By Walter Bauer, Douglas D. Bond, Henry W. Brosin, Donald W. Hastings, M. Ralph Kaufman, John M. Murray, Thomas A. C. Rennie, John Romano, and Harold G. Wolff. Edited by Helen Leland Witmer; introductory chapter by Geddes Smith. The Commonwealth Fund, New York. $3.75. x + 464 pp. 1947.

This book is the account of an experimental course in teaching psychotherapeutic medicine, given general practitioners as a pilot course under the aegis of the Commonwealth Fund. The course was given at the University of Minnesota in April 1946, by the several authors listed. Included are lectures and discussions regarding general orientation, clinical problems, history-taking, the patient-physician relationship, normal personality development, psychotherapy, psychoneuroses, anxiety states, various psychosomatic aspects, special therapies, common psychopathology, care of veterans, etc.

It is a very readable account of what must have been a most interesting experience for everyone concerned, and I have no doubt that the interested general practitioners learned a great deal from such presentations. The book should serve as a guide in the establishment of other similar projects the country over. Special projects could easily be handled in most of the large centers and would not have to be subsidized by any fund. More projects of this sort would certainly be useful both to the general practitioner and to the psychiatrist in establishing better relationships with other medical specialists, and by easing part of the psychiatric load onto the shoulders of other physicians.

WENDELL MUNCIE

THE PRACTICE OF GROUP THERAPY.

Edited by S. R. Slavson, with a foreword by Nolan D. C. Lewis. International Universities Press, New York. $5.00. 271 pp. 1947.

This is an authoritative accounting of efforts in group therapy, its general principles and dynamics, and its actual practice in various conditions, e.g., children's behavior disorders, psychopathic personalities, psychoneurotic adults, allergy patients, patients with speech disorders, psychotic patients, etc. Child therapy is considered as an activity group therapy; adult therapy, as interview group therapy. There are seventeen different authors, all able to give a good account of various topics.

WENDELL MUNCIE

PSYCHOPATHIC STATES. *Second Edition.*

By D. K. Henderson. W. W. Norton and Company, New York. $2.50. 158 pp. 1947.

This little book is a reprint of the author's Salmon Memorial Lectures, first published in 1939, and tells about all that is known concerning so-called psychopathic states or constitutional psychopathy. Henderson concludes that social rehabilitation is the method of choice, and he sees little hope from psychoanalytic or other so-called deep therapy in the treatment of such conditions.

WENDELL MUNCIE

HUMAN BIOLOGY

CONFIGURATIONS OF CULTURE GROWTH.

By A. L. Kroeber. University of California Press, Berkeley and Los Angeles. $7.50. x + 822 pp. 1944.

The reasons for undertaking this work and the aims of

the author are so succinctly stated in the preface that it seems best to repeat them here:

"One of the recognized characteristics of human culture is the tendency of its successes or highest values to occur close together in relatively brief periods within nations or limited areas. While reasons have been adduced for the phenomenon, no systemic examination of the facts seems ever to have been made. I present here the more readily datable facts—for time lapse seems an essential factor of the phenomenon—in an orderly arrangement, as basis for an inductive comparison. The purpose is not so much to offer a final explanation as to make the most pertinent data readily available for those who wish to search farther for a causality. I am convinced that, the phenomenon being cultural, the explanation must first of all be made in cultural terms, even if it be essentially only a descriptive interpretation. The underlying psychology may ultimately be discoverable; but that will necessarily be later. I have offered an adumbration of an explanation in terms of cultural patterns. This will perhaps be considered insufficient. It does not wholly satisfy me. While we know a good deal in detail about some specific culture patterns, we are only in the beginning of understanding of the nature of such patterns; even their theoretical recognition is recent. How some sharply marked patterns in civilization have actually behaved, historically, seems worth knowing as a first empirical step toward understanding; and my main endeavor has been to present organized materials on this behavior."

This work is not light reading. The opening chapter, Problem and Procedure, is perhaps from the general viewpoint the best of all. Here Kroeber states clearly and explicitly what he is undertaking to do, what the limitations are, and reveals his own belief in the dominance of cultural patterns in shaping the achievement of man.

The following chapters, wherein he traces the growth of knowledge and the peaks of achievement and the occurrence of genius, are so crammed with factual data that they may aptly be described as shoals of fact. If these do not deter the casual reader he will find more readable discussions at the end of each of these chapters.

The subjects selected for study are each assigned a chapter. These are Philosophy, Science, Philology, Sculpture, Painting, Drama, Literature, and Music. There is a chapter on the Growth of Nations which serves to organize these data by national units in order to gain a view as to the amount of concurrence of peaks of achievement in the separate fields. Finally, there is a chapter, Review and Conclusions.

This is a tremendous work by one of the most broadly learned scholars of our day. It is comparable in many ways to Toynbee's work. Both men are seeking patterns in history. Their methods of work are different and their view points are separate because of their differing backgrounds. The two works thus supplement each other. Kroeber's achievement lies in his demonstration of the importance of culture in determining the time of occurrence of genius and the flowering of culture.

GEORGE F. CARTER

CULTURAL AND NATURAL AREAS OF NATIVE NORTH AMERICA.

By A. L. Kroeber. University of California Press, Berkeley and Los Angeles. $5.00. xii + 242 pp. + 10 maps + 1 table; text ill. [1939]; 1947.

This reprinting of one of the great works of American anthropology (reviewed Q. R. B. 15: 476. 1940) needs no commendation, but instead a word of welcome at its reappearance.

THE INDIANS OF THE AMERICAS.

By John Collier. W. W. Norton and Company, New York. $3.75. 326 pp. + 8 plates. 1947.

John Collier became commissioner of Indian Affairs when Franklin D. Roosevelt was elected, and he held that post for the following twelve years. Prior to that time he had for some time been active on behalf of the Indians, defending them both against private greed and the actions of the government. This book is an explanation of what he tried to do as Commissioner of Indian Affairs, why he tried to do it, and his personal evaluation of Indian society.

There are two themes that run throughout the book. One is the strength and value of society, and particularly of Indian society. Collier maintains that the Indian had created something unique in his society, and that we have failed completely to recognize it, except in the negative way of trying to destroy it when we found it to be a source of strength to the Indians. All discussion of the Indian peoples of America is from this basic view. The discussion is often poetic, religious, even at times mystic. I do not doubt the value of societies, but many readers would more readily grasp what John Collier is trying to tell them, if he had been more concrete and less poetic. The author's second theme deals with the history of the Indian's European contacts and the aims and processes applied to the breakdown or modification of Indian culture. There is a lengthy treatment of the Spanish record in Latin America, and an equally full treatment of the North American record. Both make sickening reading. Because we are Americans and the subject comes closer home and the oppression and mistreatment reach right into the present, the second section leaves a deeper mark.

Collier is vicious in his attack on the treatment of the Indians by the United States. Most would expect this. Most will be surprised, however, to read Collier's attack on the pre-1929 Indian Service. The very organization that was theoretically to protect and aid the Indian is shown to have been its principal foe and despoiler. It is worth repeating that its destructive attitude and actions continued right up to 1929. In the earlier part of the book Collier has laid the background for understanding what he as Indian Commissioner tried to do. Indian society, including Indian

religion, was no longer to be attacked and, if possible, destroyed. Instead, these were to be encouraged. No longer was the Indian to be converted forcibly into a white man, but rather he was to be encouraged to be a s Indian as he liked. He was urged to work out his own solutions to problems in his own way. Collier admits that the program was not completely successful, but he feels that the Indian was given his first "break" since the coming of the white man to North America, that the Indians have in part experienced a spiritual rebirth as a consequence, and that a new era for these good peoples has been opened.

GEORGE F. CARTER

ETHNOGRAPHY AND ACCULTURATION OF THE FORT NELSON SLAVE. *Yale University Publications in Anthropology, Number Thirty-three.*

By John J. Honigmann.

NOTES ON THE INDIANS OF THE GREAT SLAVE LAKE AREA. *Yale University Publications in Anthropology, Number Thirty-four.*

By J. Alden Mason. Yale University Press, New Haven; Humphrey Milford, Oxford University Press, London. $2.50 (paper). (33) 170 pp.; text ill. (34) 46 pp. + 4 plates; text ill. 1946.

Honigmann here presents the results of a seven-week's stay in the trading post of Fort Nelson, gathering information from the Athabaskan Slave Indians by means of interpreters. This mass of detailed field data will be useful as source material for broader studies and possesses interest to specialists in this region. The orientation of the study is psychological and sociological. Some of the data will, therefore, also be of interest to psychologists and sociologists.

In the second part of this publication, Mason has assembled the field data that he gathered in 1913. As he explains in his preface, this was his only excursion into Athabaskan ethnology, and he has not kept up with that field but has diverted his interests elsewhere. These are only field-notes, made available to specialists in that field.

GEORGE F. CARTER

GRASSY ISLAND. *Archaeological and Botanical Investigations of an Indian Site in the Taunton River, Massachusetts. Papers of the Robert S. Peabody Foundation for Archaeology, Volume 1, Number 2.*

By Frederick Johnson and Hugh M. Raup. Phillips Academy, Andover. $1.00 (paper). viii + 68 pp. + 3 plates; ill. 1947.

Grassy Island has long been known as an archeological site. It attracts particular interest because the habitation level is beneath the present sea-level and is now covered with up to 5 feet of peat. This paper reports the results of a restudy of this site and of its implications, both cultural and chronological.

The report is unusual for its breadth and use of method. In addition to a standard treatment of artifacts, and relations of this culture to others in the region, it presents valuable evidence for a recent rise of sea-level, for the relation of a rising sea-level to the formation of peat, for the method of marsh-formation, the movement of islands, the effect of rising sea-level on the modification of meanders, etc. By relating the rise of sea-level to the thickness of peat, a tentative date is reached for abandonment of the site at about 1200 A.D. It is all too seldom that we find a slim, readable paper packed with so much interesting material. Too many papers are narrowly specialized. This one "ramifies" broadly, and its value is thereby greatly increased.

GEORGE F. CARTER

THE CANADIAN DAKOTA. *Anthropological Papers of The American Museum of Natural History, Volume 41: Part 1.*

By Wilson D. Wallis. The American Museum of Natural History, New York. $2.50 (paper). 225 pp. 1947.

The material herein presented concerns the Wahepton band of the Dakota tribe, living at Portage La Prairie Reservation. This is essentially a presentation of raw data under topical headings. Gaps have been filled, when possible by using earlier reports on the Dakota. The information is organized under the topics: Material Culture; Political Organization; Social Life; Dance Societies; Medicinemen and Medicinewomen; Clowns. There is heavy emphasis on the last three topics.

The work is valuable for its presentation of data. Since discussion has been eschewed, it is left for other workers to give this data a wider meaning. Ethnologists, sociologists, and psychologists will find it a rich source of material bearing on primitive society.

GEORGE F. CARTER

PREHISTORIC INDIANS OF THE SOUTHWEST. *The Colorado Museum of Natural History Popular Series Number 7.*

By H. M. Wormington; appendix by Erik K. Reed. The Colorado Museum of Natural History, Denver. $2.50 (cloth); $1.50 (paper). 191 pp.; ill. 1947.

This small book compresses the archeology of the Southwest into 160 pages of text. It is written for the non-professional interested in the prehistory of the area. Consequently the discussion is kept as non-technical as

possible. Its coverage is comprehensive both as to time and area. It is useful for just the purpose intended. It is a good, sound, brief survey of what is known of the archeology of the area. Its only fault is that of so many such books; it is neither good enough for a scholarly work nor light and easy enough reading for a non-scholarly work. It falls just between the two and thereby limits its audience. Only those with very considerable intellectual interest will read through it. For them it will serve as an introduction to a greater field.

GEORGE F. CARTER

CAVES OF THE UPPER GILA AND HUECO AREAS IN NEW MEXICO AND TEXAS. *Papers of the Peabody Museum of American Archaeology and Ethnology, Volume XXIV—Number 2.*

By C. B. Cosgrove. Peabody Museum of American Archaeology and Ethnology, Harvard University, Cambridge. $6.25 (paper). xvi + 181 pp. + 55 plates. 1947.

Caves in the arid Southwest are storehouses of incredible amounts of the perishable materials left by the early peoples of that region. They are particularly important for the evidence that they yield concerning such peoples as the Basket Makers, predecessors of the Pueblo people. The origin of many Basket Maker traits is still a considerable problem, as is also the relationship of the remains found in caves over a wide area in the Southwest. This monograph presents the results of work done in one of the critical areas in order to answer some of these questions of origin and relationship.

The upper Gila and the Hueco areas lie between the classic Basket Maker areas of northern Arizona and southern Utah, on the one hand, and the area of the Cave Dwellers culture of the lower Pecos River and the Big Bend region of the Rio Grande, on the other. This area also lies athwart one of the possible routes of diffusion of traits from Mexico and Central America to the Southwest. It is this that gives the present report special value. Cosgrove considers the material reported on here to indicate a considerable relationship of its producers to the Basket Maker people, although it also shows considerable relationship to the Big Bend Cave Dwellers. This is about what one would expect from its geographical position.

Most unfortunately, this work was written up in 1934 shortly before Cosgrove's death. As a consequence, the very important evidence from the plant materials present in the collections has not been utilized. (The major advances in our ability to use domestic plants for the identification of cultures dates from 1940.) Even so the material reported and illustrated is of great interest. Some of the corn reported is many-rowed and hence may be related to the early Basket Maker material of the San Juan.

The report is profusely illustrated, the materials are carefully described, and comparisons have been made with neighboring areas and related cultures. It is with deep regret that one realizes that there will be no more such work by this man.

GEORGE F. CARTER

SAN BLAS CUNA ACCULTURATION: AN INTRODUCTION. *Viking Fund Publications in Anthropology Number Nine.*

By D. B. Stout. The Viking Fund, New York. $2.50 (paper). 124 pp. + 16 plates. 1947.

Material on the San Blas Cuna of the islands off Panama is here assembled. An unusually long record is available because of the early importance of Panama. The material from these early records is used to compare and contrast with the ethnology of the present-day Cuna, as recorded during a five-month's stay by the author. The report is concisely written and packed with facts.

Particular interest is attached to the processes of acculturation through the long period of contact. The Cuna are shown to have but recently moved to the islands. The shifts in their ways of life consequent upon this migration are numerous. They have always remained aloof from the negroes and the Spanish peoples. Recently they have become enamored of the Americans, and are striving for cultural identification with them. Values are shifting from their older emphasis on farming and fishing to work in town; from subsistence to cash trade for necessities, etc. Such studies are of great value, for the processes of acculturation and the attendant dislocations and cultural breakdowns are world-wide problems and seemingly will not only continue but will accelerate in the future.

GEORGE F. CARTER

INDIAN SKELETAL MATERIAL FROM THE CENTRAL COAST OF PERU. *Expeditions to Southern Peru, Peabody Museum, Harvard University, Report Number 4. Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University, Volume XXVII—Number 4.*

By Marshall T. Newman, with a synopsis of the Archaeology by Gordon R. Willey. Peabody Museum of American Archaeology and Ethnology, Harvard University, Cambridge. $2.50 (paper). x + 72 pp. + 4 plates. 1947.

This detailed study attempts to analyse the ancient racial history of the Central Coast of Peru on the basis of much skeletal material from all four known cultural

periods of that area. The latter are discussed briefly in *A Synopsis of the Archaeology*, by G. R. Willey, which considers specially the sites from which the skeletons used here were recovered. A total of 231 skulls were available for craniometric examination; other skeletal parts were not measured, but were used in assessing age and for the study of the frequency of pathological conditions, which are surprisingly rare in this material. Artificial cranial deformation of marked degrees is prevalent in skulls from the earlier periods, but has nearly disappeared in those of the later ones.

The aboriginal Peruvian population under investigation shows only subracial variations. The various cranial series all indicate "a basic population of one racial stock which varies from period to period and valley to valley because of the amalgamation of outside racial elements and intra-valley genetic change. This basic racial group is characteristically short in stature, small vaulted, brachycranic, mostly high-headed, medium in facial proportions, below average in prognathism," etc.

A. H. SCHULTZ

THE ETHNOGEOGRAPHIC BOARD. *Smithsonian Miscellaneous Collections, Volume 107, Number 1. Publication 3889.*

By Wendell Clark Bennett. Smithsonian Institution, Washington, D. C. 65 cents (paper). viii + 135 pp. 1947.

The Ethnogeographic Board was set up in an effort to make the country's scholarly and scientific resources available for emergency use during the war. In the words of the author, this is "a historical account of the work, an appraisal of the experience, and constructive suggestions for the consideration of the Sponsors as to the most effective ways of organizing the scholarly and scientific resources, which they represent, for public service." The background of the problem that led to the founding of the Board, its organization, budget, and activities and projects are all presented. Future problems are discussed with special emphasis on problems of area experts, materials, reports, and training.

The Board served a useful purpose. Should an emergency again arise, this report would enable the rapid establishment of a similar organization.

GEORGE F. CARTER

AN AFRICAN ARISTOCRACY. *Rank Among the Swazi. A Publication of the International African Institute.*

By Hilda Kuper. Oxford University Press, London, New York, and Toronto. $8.00. xii + 252 pp. + 16 plates + 1 map. 1947.

The author has felt that an analysis of Swazi culture, which she had studied for several years, would be most fruitful when revolving around the social structure of this South African kingdom, now a "protectorate." She gives the story of the conquest of the country by the now ruling clan of the Dlamini, and tells how two-thirds of Swaziland were stolen by the South African Dutch and English.

The economic foundations of Swazi society are those familiar from so many other excellent monographs on the Southern Bantu (by Junod and others): a primitive agriculture, depending upon a plurality of wives, "bought" with cattle. The fundamental political idea of these kingdoms—that the land belongs to and is mystically identified with the king—takes its special Swazi elaboration along the lines of a highly developed aristocracy and a dual monarchy (king and queen-mother). As a conquering kingdom, the Swazi stressed military organization in regiments formed by age groups. As in other African societies, it is impossible to overlook the strong similarities here with early medieval European feudalism in structure and attitudes; and the advantages that the British have derived from preserving medieval forms in their own political structure (king, queen-mother, etc.) when integrating such "primitive cultures."

The author has analysed in detail the weak and strong spots of Swazi political arrangements, and the reflection and reinforcement of the politico-social structure in religion and ritual. A great number of interesting data are reported clearly and intelligently. It is an excellent monograph.

ERWIN H. ACKERKNECHT

THE MOUNTAIN ARAPESH. *III. Socio-Economic Life; IV. Diary of Events in Alitoa. Anthropological Papers of The American Museum of Natural History, Volume 40, Part 3.*

By Margaret Mead. The American Museum of Natural History, New York. $2.50 (paper). Pp. 159–420 + 4 plates. 1947.

These are the third and fourth issues of a series of very detailed anthropological studies dealing with the culture of the Arapesh people, who live in the mountains of the mandated Territory of New Guinea. The first paper (of 60 pages) describes the socio-economic life in this primitive society, dwelling chiefly on the complicated kinship systems and other social relationships and on the economic structure of the community, the work performed, the property owned and the rules concerning inheritance, payment for services rendered, feasts, etc., and, last but not least, the inter-relationships between these varied topics. The second and much longer paper is a novel attempt to picture minutely the actual, intimate behavior of these natives by means of a diary accounting fully for stage-setting, actors, and

play in a half-year's life of a small group of these aborigines. No event or circumstance seems too trivial for this faithful, patient portrayal of human existence at a low level of cultural development. Every quarrel, illness, infidelity, marriage, sorcery, etc., is recorded, and the reaction of the people to them is noted. Altogether this forms a valuable, comprehensive record of anthropological observations, particularly welcome for later comparative studies. The present report contains no summary and no general conclusions.

A. H. SCHULTZ

ACRES AND PEOPLE. *The Eternal Problem of China and India.*

By Earley Vernon Wilcox. Orange Judd Publishing Company, New York. $3.00. 297 pp.; ill. 1947.

From personal observation and wide consultation of standard works, the author of *Acres and People* has learned enough about the Orient to write a good, but scarcely original, study of the population problems of India and China. In his comparisons of the two peoples, he is rather overly impressed by the more favorable status of the Chinese, whom he regards as better off in nearly every way. Consequently, although he probably does not exaggerate the difficulties of India's food and population problem, he seems to make light of that which faces the Chinese. The book ends with a wholehearted outburst of admiration for the Filipinos.

Many parts of the book seem to have been written before or early during the war. The lengthy discussions of political matters date back to a time when in India the Cripps proposals were new and in China the great westward migration ahead of the Japanese had just begun. Why such a book should be published in 1947, without extensive revision, is indeed a mystery.

BENTLEY GLASS

EUROPE'S POPULATION IN THE INTERWAR YEARS. *Series of League of Nation Publications. II. Economic and Financial 1946. II. A. 8.*

By Dudley Kirk. Economic, Financial and Transit Department, League of Nations, Geneva; Columbia University Press, New York. xii + 307 pp. + 8 maps; ill. 1946.

This book will be warmly welcomed by biologists and other citizens who have felt vexed by the propensity of *Homo sapiens* to conduct his affairs within the more or less watertight compartments of national states and by the resulting difficulty of studying these affairs in terms of larger geographical units. Using as his main sources the census and vital statistics of the period between the First and Second World Wars, Dudley Kirk has presented us with a demographic analysis, not of a series of countries, but of a continent as a whole. Wherever possible, data are shown for some six hundred administrative districts, a procedure which throws into relief important patterns often obscured by the use of national averages.

After a brief introduction, three chapters deal with population distribution and population change and with the biological factors that determine the direction and rate of change, fertility and mortality. The next four chapters are devoted to migration—overseas, international within Europe, and internal—and its role in population growth. The ninth chapter presents the continental patterns in the fields of health, literacy, occupational structure, and agricultural productivity. This is followed by a discussion of ethnic diversity and language. In the concluding chapter the demographic situation of Europe is analysed in relation to the world as a whole. Author and publisher have managed to keep their book readable by excluding the bulk of statistical tables from the main body of the text. They are presented in a number of very useful appendices. Much of this information is not readily available anywhere else, and for any scholar to reassemble it would require years of work. Ample use has been made of diagrams and maps which are a pleasure to behold.

CHRISTOPHER TIETZE

SOCIALITY IN PREADOLESCENT BOYS. *Teachers College, Columbia University Contributions to Education, Number 918.*

By Ruth Edith Hartley. Bureau of Publications, Teachers College, Columbia University, New York. $1.85. viii + 117 pp. 1946.

This study reports a research project on the measurement of sociality in preadolescent boys, the reliability and validity of the measures, and the interrelationships among them. Two aspects of sociality were studied: (1) *extensity*, indicating the number of different people toward whom the individual has positive social relations and (2) *intensity*, the intensity of these relations. Several tests of each aspect were studied. Individual tests are reasonably reliable, but the low correlation between various tests does not confirm the existence of two such factors of sociality. Measures of extensity and intensity are not highly correlated. The tests as a group can probably differentiate groups of highly sociable children from those who are unsociable—if they are selected by skilled judges—but several of the individual tests do not discriminate significantly. The analysis of the meaning of the pattern of test scores in individual cases suggests some very interesting interpretations of the scores, but further validation will be required to establish the meaning of such patterns.

ALFRED L. BALDWIN

MAN AND OTHER LIVING THINGS: *An Introduction to Human Biology.*

By Francis G. W. Knowles. George G. Harrap & Company, London. 10s. 6d. 355 pp. + 32 plates. 1945.

There are so many extraordinarily fine things about this British textbook of biology for secondary school students that only a few can be enumerated. Suffice it to say that every aspect of biology is well taken care of, in an interesting and accurate fashion, not too attenuated nor over-difficult for the sub-college level. The book begins with a study of the house-fly as a representative animal and the buttercup as a representative plant, and goes on to take up the composition of living things, classification, plant and animal nutrition, respiration, transport, movement and support, excretion, the nervous system, hormones and glands, growth and size, and reproduction, including the human. The Invention of the Microscope is a chapter typical of the emphasis laid on the development of biological knowledge, and this is also seen in the discussion of bacteria and viruses that follows. The protozoa and algae, the fungi, symbiotic and social life, and biological control form a unit that is followed by several chapters on evolution and a final discussion about heredity. There is a good selection of books for further reading, a section of experiments and observations planned to acccompany each chapter, and an index. The illustrations, particularly the full-page, beautifully reproduced halftones, are outstanding. Accuracy in all respects is characteristic. The slenderness of the volume contrasts sharply with our overstuffed American products. In short, it is clear that the great tradition of popular biology teaching and writing that stemmed from T. H. Huxley to J. A. Thomson, Wells, Huxley, and Wells, and Lancelot Hogben continues to bear worthy fruit.

BENTLEY GLASS

THE MARRIAGE READER: *A Guide to Sex Satisfaction and Happiness in Marriage.*

Edited by Samuel G. Kling and Esther B. Kling. The Vanguard Press, New York. $3.00. xii + 489 pp. 1947.

This anthology on marriage contains a wide variety of good and bad, with the former exceeding the latter by a comfortable margin. Sage and sociologist offer advice freely on sexual adjustment and sterility. To marry early or to marry late, to marry like or to marry unlike, to marry with romantic love or without romantic love, to have children or to adopt children, to sleep in a single bed or in twin beds or in separate rooms—these and many other crucial questions of marital adjustment are carefully considered. A galaxy of seers—Balzac and Benjamin Franklin, Havelock Ellis, Eleanor Roosevelt, and Bertrand Russell, Alfred Adler and André Maurois, and, of course, Margaret Sanger, Marie Stopes, and Hannah Stone—mingle with less well-known contributors who may speak their views less ardently but with more scientific caution: Henry Bowman, sociologist, talks plain common sense on the difficulties of making the necessary adjustments in Mixed Marriages of any sort, nationality, religion, age, intelligence, economic status; Millard S. Everett comments sensibly on Romantic Love, and is matter-of-fact about the Anatomy and Physiology of Sex; Evelyn M. Duvall and Reuben Hill are excellent on What Holds a Marriage Together.

The editors have really done a fair job of selection from the oceans of literature on sex and marital adjustment, with only an occasional obvious lapse, such as the inclusion of a selection on The Hygiene of Pregnancy (W. J. Fielding) that not only bears the marks of its age (22 years) but was filled with appalling biological errors even at the time of its conception. This is definitely not a book for the biologist; but the general public, for which it has been compiled, may look farther and fare worse.

BENTLEY GLASS

BIOMETRY

MÉTHODES STATISTIQUES EN MÉDICINE ET EN BIOLOGIE.

By E. Morice, with the collaboration of M. Tisserand and J. Reboul; preface by A. Baudouin. Masson & Cie., Paris. 480 fr. (paper). xx + 182 pp.; ill. 1947.

This is a textbook on elementary statistical methods. As its title implies, the examples and illustrations are drawn from the fields of biology and medicine. The simpler descriptive statistics receive adequate coverage; but the sampling statistics are treated less thoroughly and are confined to the standard error of the mean, the t-test for significance between means, and the significance of percentages and correlation coefficients. Although limited in comprehensiveness, this treatment should still enable the researcher to handle a great variety of problems.

In addition to these conventional topics, there is a good chapter on statistical charts. It discusses Cartesian-coordinate and polar-coordinate charts, bar diagrams, sector charts, cartograms, three-dimensional charts, and logarithmic scales. This topic is all too often neglected in elementary statistics, and the discussion here should be very useful in showing the student how to present statistical data graphically. There is also a good chapter on the collection of statistical data. It begins with a point of view which the reviewer feels cannot be over-emphasized: Statistics are a tool; they are nc better than the original data.

The authors' approach to correlation as an analysis-of-variance problem is unusual for an elementary text. Since the reviewer feels that this is a reasonable way to teach correlational methods, he cannot help but endorse the authors' approach. Also noteworthy are the graphical "abaques" for showing the significance of chi-square, t, and r, and the z transformation of r. Although slightly less accurate than tables, these abacs are much simpler to use in problems which require interpolation, as most do.

All in all, this is a sound book, well-written, and easy to follow. The foreign language, however, will undoubtedly limit its usefulness for students in this country.

A. CHAPANIS

SELECTED TECHNIQUES OF STATISTICAL ANALYSIS *for Scientific and Industrial Research and Production and Management Engineering.*

By the Statistical Research Group, Columbia University; edited by Churchill Eisenhart, Millard W. Hastay and W. Allen Wallis. McGraw-Hill Book Company, New York and London. $6.00. xiv + 473 pp. + 1 chart; ill. 1947.

During the war, the Statistical Research Group at Columbia University advised and assisted the Army, Navy, and Office of Scientific Research and Development on the statistical aspects of problems arising in their activities. It was almost inevitable that in the course of this work the group would encounter some problems which required the elaboration and development of certain specialized statistical techniques. This book is a compendium of those statistical developments which were by-products, as it were, of the solutions to practical military, scientific, engineering, and production problems.

The book contains 17 chapters, each written by one or more members of the group. The material falls into three parts: I. Industrial Statistics; II. Planning Experiments; and III. Techniques and Tables. Because of its origin, this is not an integrated textbook on statistics. It is rather a series of fairly intensive studies of selected statistical methods.

As compared with other texts in this field, this one is at a medium level of difficulty. It appears to be suitable for those readers who already have some understanding of elementary descriptive and sampling statistics. Most of the topics discussed are oriented toward industrial or engineering problems, but the biometrist should find a few items of interest among them. The inverse sine transformation of proportions—which was first introduced by way of theoretical genetics—receives a fairly detailed discussion, for example. There is an excellent chapter on the Effects of Rounding or Grouping Data, and there are several other good ones on planning efficient experiments for estimating or comparing certain statistics.

This is the kind of book which the professional statistician or biometrician will probably want to have. The ordinary research worker, however, is likely to find it of little use.

A. CHAPANIS

DE OMNIBUS REBUS ET QUIBUSDEM ALIIS

RESEARCH: *A Journal of Science and its Application. Volume I, Numbers 1 and 2, October and November, 1947. Monthly.*

Edited by P. Rosbaud and D. R. Rexworthy. Butterworths Scientific Publications, London. Annual subscription, £2 5s.; $10.00.

The laudable aims of the new journal *Research* are to provide the technical specialist with an idea of what is going on in other fields than his own, and to assist the pure scientist to realize what an enormous amount of industrial research must go on before a new scientific discovery can find its way into practical applications. The contents, judging from the second issue, will fall chiefly in the realm of the physical sciences, but not altogether. There is an article of biological interest, on Science in Whaling, by C. E. Ash, in this issue. Important biological books will also be reviewed.

SCIENCE NEWS—4, 5.

Edited by John Enogat. Penguin Books, West Drayton, Middlesex. 1s. each (paper). (4) 171 pp. + 16 plates; text ill.; (5) 168 pp. + 16 plates; text ill. 1947.

Number 4 includes popular biological articles on the following subjects: Life at High Pressures (J. B. S. Haldane); Medical News; The Control of Flowering (E. Ashby).

Number 5 includes: Physical Treatment of Mental Illness (A. Lewis); Cave Science (M. Pavan); Biochemical Aspects of the Soil (J. H. Quastel); The Common Cold; Medical Front (J. Enogat); How Messages are Transmitted Along Nerves (W. A. H. Rushton).

MIDDLE EAST SCIENCE: *A Survey of Subjects Other Than Agriculture. A Report to the Director General Middle East Supply Centre, August 1945.*

By E. B. Worthington. His Majesty's Stationery Office, London. $1.60. xiv + 239 pp. + 16 plates + 2 maps. 1946.

Scientific problems and resources in the Middle East are, on the whole, poorly understood and little appreciated except by those who have a special interest in

that area. When, with the advent of the war, the Middle East Supply Centre was established by the British to ensure the civil populations in the Middle East countries those supplies which were essential for their livelihood in wartime, the need for expert scientific study soon became evident. This book is a report of such a scientific survey. The area covered consists of Egypt, the Sudan, Palestine, Transjordan, Lebanon, Syria, Iraq, Cyprus, Persia, Arabia (in entirety), Ethiopia, Eritrea, the Somalilands, Cyrenaica, Tripolitania, and Malta. The survey considers basic problems of living, land surveys, geology, meteorology, rivers and underground water, plants, animals, forestry, marine and inland fisheries, human diseases, health and medical service, and population and social studies. Maps and fine photographs are included. This report is especially valuable in bringing together references to most of the important and frequently obscure scientific literature pertaining to the area and in pointing out the many lacunae in our knowledge.

V. G. DETHIER

AWAY FROM THE HERE AND NOW. *Stories in Pseudo-Science.*

By Clare Winger Harris. Dorrance & Company, Philadelphia. $2.50. 365 pp. 1947.

Having been informed by a recent magazine article that some of the greatest living scientists,—including a Nobel Prize winner or two,—are addicted to "science fiction," Percy, our new office boy, told us we ought to look some of these stories over. "What's the use of reading these 'Recent Advances' in this and that," he asked, "when the fiction writers have already got it doped out for the next century, anyway?" So we have read some of those stories, and are now practically convinced. At least we haven't been able to sleep so soundly since peering into the future. Take Clare Harris, now. She hasn't the style of William Morton Wheeler or William Beebe; but her narrative, unhampered by grammatical niceties, or the need to portray characters with psychological penetration, moves at a pace rather bewildering to one so long accustomed to the biological reviews. There is enough science in the back-ground to make these stories of interplanetary travels, war with insects, men with artificial organs, speeded up evolution, and apes bred for intelligent servitude to man have a ring of plausibility. Some of them might, in fact, be regarded as extrapolations of the soberer predictions of Jean Rostand, Harry Shapiro, and others. All in all, it is rather like seeing yourself in one of the distorting mirrors at Coney Island.

INTERTONGUING MARINE AND NONMARINE UPPER CRETACEOUS DEPOSITS OF NEW MEXICO, ARIZONA, AND SOUTHWESTERN COLORADO. *The Geological Society of America. Memoir 24.*

By William S. Pike, Jr. The Geological Society of America, New York. $2.25. x + 103 pp. + 9 plates + 1 chart; text ill. 1947.

A LIST AND INDEX OF THE PUBLICATIONS OF THE UNITED STATES NATIONAL MUSEUM (1875–1946). *Smithsonian Institution, United States National Museum. Bulletin 193.*

Compiled in the Editorial Division, Smithsonian Institution. United States Government Printing Office, Washington, D. C. $1.00 (paper). iv + 306 pp. 1947.